PROGRAM PLAN, AGENDA AND REFERENCE MATERIALS

NAVAL AVIATION BIOMEDICINE/HUMAN EFFECTIVENESS TECHNICAL WORKSHOP

Fiscal Year 1979

DRAFT

CNR REMARKS

IT IS AN HONOR AND PRIVILEGE TO JOIN IN THE BRIEFING PHASE OF THE THIRD WORKSHOP ON NAVAL AVIATION BIOMEDICINE AND HUMAN EFFECTIVENESS. AS CHIEF OF NAVAL RESEARCH I CHALLENGE THIS WORKING GROUP TO IDENTIFY THE PROBLEMS WHICH REQUIRE BASIC AND APPLIED RESEARCH AND WHERE POSSIBLE POINT TOWARD THE SOLUTION OF THOSE PROBLEMS. I REALIZE THAT YOU WILL DEAL WITH ALL CATEGORIES OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION (RDT&E). IT IS VERY IMPORTANT THAT YOU DEAL WITH THE RDT&E CATEGORIES IN A MANNER THAT WILL ENSURE SEPARATE CONSIDERATION IN YOUR FINAL REPORT. I WOULD REMIND YOU THAT THE MANAGEMENT OF RESEARCH (6.1) PROGRAMS IS CONSIDERABLY DIFFERENT FROM THE MANAGEMENT OF ENGINEERING DEVELOPMENT (6.4) PROGRAMS. THE RESEARCHER MUST NOT ONLY BE AWARE OF THE PROBLEMS ASSOCIATED WITH THE NAVAL ENVIRONMENT OF TODAY, HE MUST BE ABLE TO VISUALIZE THE POTENTIAL PROBLEMS ASSOCIATED WITH NAVAL SYSTEMS AND OPERATIONS A DECADE HENCE.

RECENTLY I HAVE GIVEN THE NAVY RESEARCH PROGRAM MANAGERS GUIDANCE ON THE FY 1980 RDT&E,N BUDGET. I WOULD LIKE TO GIVE THIS WORKSHOP GROUP THE BENEFIT OF APPROPRIATE PORTIONS OF THAT GUIDANCE (I.E., THE MEAT NOT THE DETAILS)

FIRST COMES GENERAL CONSIDERATIONS. OVER THE PAST DECADE, RESEARCH BUDGETS HAVE FAILED TO KEEP PACE WITH INFLATION AND CONSEQUENTLY HAVE FALLEN TO LEVELS THAT ARE SUFFICIENTLY LOW TO CAUSE CONCERN. THIS PROBLEM HAS BEEN RECOGNIZED AT THE DOD LEVEL AND A GOAL HAS BEEN SET OF 10% REAL GROWTH EACH YEAR IN BASIC RESEARCH OVER THE NEXT SEVERAL YEARS, AN INCREASE THAT WOULD PROVIDE THE NAVY WITH AN IMPROVED POSTURE IN DEALING WITH ITS PRESENT AND FUTURE CHALLENGES. THE PURPOSE OF THIS SECTION IS TO PROVIDE GUIDANCE TO NAVAL RESEARCH PROGRAM CLAIMANTS IN STRUCTURING THEIR INDIVIDUAL PROGRAMS TO MEET OVERALL NAVY OBJECTIVES IN LIGHT OF THE ABOVE GOAL.

IT SHOULD BE UNDERSTOOD THAT THE PROPOSED REAL GROWTH WILL NOT NECESSARILY BE APPORTIONED UNIFORMLY TO INDIVIDUAL CLAIMANTS OR DISCIPLINES. EACH CLAIMANT WILL HAVE TO JUSTIFY HIS COMPLETE

PROGRAM. CLAIMANTS ARE INVITED TO GIVE SPECIAL CONSIDERATION TO PROPOSING NEW PROGRAMMATIC OR PROCEDURAL INITIATIVES DESIGNED (A) TO ACCELERATE THE FLOW OF RESEARCH ADVANCES INTO NAVAL APPLICATIONS; (B) TO IMPROVE NAVY TIES TO UNIVERSITY RESEARCH CENTERS; AND (C) TO EMPHASIZE LONG-RANGE RESEARCH THAT MAY IMPACT FUTURE NAVY CAPABILITIES.

NEXT COMES GUIDANCE FOR INDIVIDUAL CLAIMANTS. IN ADDITION TO THE REQUIREMENTS THAT ALL WORK INCLUDED IN THE RESEARCH PROGRAM MUST MEET HIGH STANDARDS FOR CONTENT, IMPLEMENTATION, AND NAVY INTEREST, THERE ARE OBJECTIVES THAT ARE SPECIFIC TO THE INDIVIDUAL CLAIMANTS.

THE ONR CONTRACT RESEARCH PROGRAM: THIS PROGRAM SHOULD OPERATE PRIMARILY AT THE RESEARCH FRONTIERS AND THUS SHOULD INCLUDE THE NAVY'S MAJOR INVESTMENT IN LONG RANGE RESEARCH. IT SHOULD ALSO INCLUDE EFFORT TO LAY THE FUNDAMENTAL GROUNDWORK FOR ASSESSMENT, AND WHEN APPROPRIATE TO INITIATE EXPLOITATION, OF PROMISING NEW IDEAS OR TECHNIQUES. IT SHOULD CULTIVATE THE MAIN BODY OF THE NATIONAL RESEARCH COMMUNITY AND INTEREST

THEM IN NAVY PROBLEMS. WHILE IT SHOULD INCLUDE INVESTIGATORS OF PROVEN EXCELLENCE, IT SHOULD ALSO DEVELOP A FUTURE CONSTITUENCY BY INCLUDING YOUNG INVESTIGATORS WHO EXHIBIT VERIFIABLE PROMISE. THE PROGRAM SHOULD SEEK TO INCORPORATE AN INCREASING AMOUNT OF THE MANAGEMENT APPROACH WHEREIN SPECIFIC FIELDS--PRESELECTED FOR SCIENTIFIC/TECHNICAL PROMISE AND SPECIAL NAVAL INTEREST--ARE GIVEN EMPHASIS IN THE FORM OF LARGER BLOCKS OF EFFORT, LONGER CONTINUITY, AND GREATER SCIENTIFIC MANAGEMENT BY THE PRINCIPAL INVESTIGATOR.

Transitions and Objectives

THE NAVAL MATERIAL COMMAND R&D CENTERS, THE NAVAL SYSTEMS COMMANDS AND LAST BUT NOT LEAST THE BUREAU OF MEDICINE AND SURGERY AND ITS NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND: THE PRINCIPAL EMPHASIS FOR THESE CLAIMANTS SHOULD BE THE ACCELERATION OF RESEARCH RESULTS INTO DEVELOPMENT, AND GAP-FILLING RESEARCH IN AREAS REVEALED AS DEFICIENT BY DEVELOPMENT EFFORTS. TYPICALLY, THE RESEARCH HERE SHOULD BE MORE SPECIALIZED AND DEDICATED TO A NEARER-TERM PAYOFF. THE RESEARCH EFFORTS OF THE R&D CENTERS SHOULD ALLOW THEM TO KEEP IN CONTACT WITH RESEARCH

PERTINENT TO THEIR MISSIONS, AND SHOULD PROVIDE THEM WITH THE FLEXIBILITY NECESSARY TO BE INNOVATIVE.

IN SUMMARY I WANT YOU ALL TO KNOW THAT THE OFFICE OF NAVAL RESEARCH INTENDS TO SUPPORT A VIGOROUS AND RESPONSIVE BASIC RESEARCH PROGRAM RELATED TO AVIATION MEDICINE AND HUMAN PERFORMANCE. EFFORT IN THE WELL RECOGNIZED AREAS OF IMPACT INJURY, MOTION AND VIBRATION AFFECTS, THERMAL PHYSIOLOGY, HEARING CONSERVATION, LIFE SUPPORT AND PERSONAL PROTECTION SYSTEMS, AND HUMAN FACTORS WILL CONTINUE. I WOULD LIKE FOR YOU TO ADDRESS IN YOUR DELIBERATIONS THE NEED FOR NAVY EFFORT IN THE FOOD RDT&E PROGRAM, AND THE RDT&E PROGRAM ON CHEMICAL WEAPONS AND CHEMICAL AND BIOLOGICAL DEFENSE. THESE TWO AREAS PRESENTLY ARE ASSIGNED BY THE DEPARTMENT OF DEFENSE TO THE ARMY AS EXECUTIVE AGENT FOR PLANNING AND PROGRAMMING.

IT HAS BEEN A PLEASURE TO PARTICIPATE IN THIS MORNINGS BRIEFING AND I HOPE YOU WILL HAVE A VERY PRODUCTIVE WORKSHOP IN CHARLOTTESVILLE AT THE LUXURIOUS BOAR'S HEAD INN.

PROGRAM PLAN, AGENDA, AND REFERENCE MATERIALS

NAVAL AVIATION BIOMEDICINE/HUMAN EFFECTIVENESS TECHNICAL WORKSHOP

11-12 January 1979
Washington, D. C.

14-18 January 1979
Charlottesville, Virginia

Distribution of this document is controlled by Code 440B, Office of Naval Research and is limited to workshop participants

Prepared by

DOT SYSTEMS, INC.

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INTRODUCTION

This Technical Workshop for Aviation Biomedicine/Human Effectiveness is sponsored by the Office of Naval Research, Naval Air Systems Command, and the Naval Medical Research and Development Command.

As indicated in the Agenda, Appendix A, the workshop comprises two phases, a briefing phase and a workshop phase.

The briefing phase is a classified session to be conducted in the Surgeon General's conference room at the Bureau of Medicine and Surgery. Speakers for the briefing have been selected to provide a broad range of operational aviation matters now and projected into the future. Their input will provide a basis for identification of future Navy research in biomedicine/human effectiveness by the participants at the workshop and is anticipated to impact on their future research endeavors.

The workshop phase will be conducted at the Boar's Head Inn, Charlottesville, Virginia. This location has been selected because it isolates participants from work interruption and provides facilities where a group of experts can be brought together in an atmosphere that is conducive to fulfillment of the workshop objectives.

Each participant has been assigned to a committee. Assignment to a particular committee has been determined by evaluation by the steering committee of each individual's talents and identification of committee expertise requirements essential to ensure a comprehensive assessment of all factors relevant to the committee. Although participants provide representation from each of the various Navy research and research management commands or activities that are involved in relevant research, participants are expected to serve as experts in their respective fields rather than as representatives of a particular command.

This workshop will employ the Report of the Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Fiscal Year 1974 as the foundation for its work. Through study of this report and other materials by participants prior to the workshop meeting, it is anticipated that little of the limited time available will be required to familiarize participants with historical Naval Aviation Biomedicine/Human Effectiveness issues and participants will be free to devote their full time and attention to assessment of current research and definition of future research requirements.

Each committee (Appendix B) of the workshop will be responsible for the development and presentation of its report prior to the conclusion of the workshop. The report, as accepted by the workshop membership, will be incorporated into the workshop report and published shortly after conclusion of the workshop. In order for the committees to prepare their reports within the limited time available it is essential that each participant be thoroughly prepared for the workshop and that each committee chairman have a well defined plan of operation developed prior to the workshop.

In order to facilitate committee work, support personnel will be on-site to provide secretarial and other administrative support.

WORKSHOP OBJECTIVES

The objectives of the Fiscal Year 1979 Naval Aviation Biomedicine/ Human Effectiveness Technical Workshop are:

(1) To familiarize selected representatives of the research community with a broad range of naval aviation operational matters including techniques, equipment and contingencies that impact on naval aviation biomedicine/human effectiveness research requirements.

(2) To provide a forum for the review of the overall Navy RDT&E program and for the exchange of information between members of the research community.

(3) To review the current research program to ascertain its relevancy to operational requirements and practical worth with respect to research accomplishments.

(4) To identify and document deficiencies in the current research program and to recommend future research by order of priority.

(5) To assess the total naval aviation biomedicine/human effectiveness research capability (staff facilities, equipment, etc.) and to define and document recommendations to overcome deficiencies.

WORKSHOP PROCEDURES

The workshop is divided into two phases: (1) a briefing phase and (2) a workshop phase. The agenda, Appendix A, presents these two phases.

The Briefing Phase

This portion of the workshop will be conducted in the Surgeon General's conference room at the Bureau of Medicine and Surgery because the honored speakers and operational briefers are from the immediate area and because the session is classified.

Participants are reminded that they will not be allowed access to this briefing session unless they have secret security clearance and appropriate administrative action has been taken to notify the BUMED security officer of their clearance and attandance at the briefing.

Participants requiring parking space at BUMED should check with the person on duty at the desk in building number one. The guard at the entrance to the compound will provide directions for reaching building number one.

The Workshop Phase

Check-in, room assignment, and registration have been scheduled for Sunday afternoon January 14, 1979. Because of the very limited time available to the workshop it is considered essential that all participants report to the Boar's Head Inn at the scheduled time so that no time will be taken from the work schedule for administrative details. A "happy hour" get-acquainted period has been scheduled for Sunday evening. During your stay at the Boar's Head Inn meals may be obtained at the Inn or elsewhere at your option. A coat and tie are required at the evening meal at the Boar's Head Inn.

The conduct of the workshop will be regulated by a steering committee composed of the following members:

Captain Roger G. Ireland, MC, USN, (OPNAV), Chairman
Dr. Arthur B. Callahan, (ONR)
Mr. Henry A. Fedrizzi, (NAVAIR)
Captain David B. Miller, USN, (OPNAV)
Captain Ronald K. Ohslund, MC, USN, (NMR&DC/ONR)
Commander Donald H. Reid, MSC, USN, (ONR), Executive Secretary

Periodically throughout the conduct of the workshop members of the Steering Committee will join the various working committees and will at scheduled times (see the agenda) meet with the committee chairman.

The major function of the Steering Committee is to ensure accomplishment of the workshop objectives. To this end, members will direct their efforts toward ensuring comprehensive assessment of the relevant research requirements to meet current and future operational needs.

Committees of the workshop will include the following:

Committee	Chairman	
	Primary	Alternate
A - Life Support and Survival Systems	Mr. De Simone	LCDR Pheeny
B - Physiological Assessment	CAPT Wenger	LCDR Call
C - Human Effectiveness	CDR Gregoire	CDR Kennedy
D - Clinical Aerospace Medicine	CAPT Lestage	CAPT Tyler

Alternate chairmen are to serve as chairman in the absence of the primary chairman.

Committee chairman are responsible for organizing and managing their respective committees to ensure comprehensive assessment of the Navy research requirements relative to the committee as indicated by the committee name.

Each committee will prepare a report that as a minimum provides the following:

- An overview of the committee related research indicating the thrust of former research; changes, if any, in operation requirements and a

concise definition of future research as it relates to operational needs.

- Identification of specific research, proposed resource application and the relative priority of research identified. Research should be identified by development category (6.1, 6.2, 6.3, etc. see Appendix C) and level of effort.

  A - Work on this problem is imperative to support mission needs.

  B - Work is desirable to provide a better data base to support this need.

  C - Work is needed, but adequate effort is being supported in other Navy, Air Force, or civilian research programs.

  D - No further effort is needed in this research area to meet the needs of naval aviation.

  Level of effort, D above, may be used to indicate a recommendation for discontinuance of a current research effort.

A summary of new research needs should be incorporated in each committee report (see Chapter 6 of the FY-74 report).

For additional guidance in preparation of the committee report see the reports compiled by the Fiscal Year 1974 workshop.

THE RESEARCH PROCESS

OPNAVINST 5000.42A, Weapons Systems Selection and Planning, establishes procedures for identifying operational requirements and conducting management reviews during system acquisition. Within this framework a Science Technology Objectives Master Document has been developed for Personnel/Medical Task Support that describes in broad terms the Navy's needs and problems requiring R & D solutions, and are based on the Navy's role, objectives, and threat anticipated in the 10-to-20 year future time frame.

Operational requirements (OR's) are then defined and development proposals (P's) are prepared to present alternatives and tradeoffs to achieve a particular range of capabilities, in response to the OR. Navy Decision Coordinating Papers (NDCP's) are then prepared to provide approval for program starts and subsume associated OR's and DP's.

Appendix D of this document is OPNAVINST 5000.42A. Appendix E is that portion of the Science and Technology Objectives (STO) Master Document relating to Personnel/Medical Task Support (See Enclosure (2), Section II, RDT&E Planning Categories, of OPNAVINST 5000.42A IV. Mission Support A. Personnel/ Medical (PN)).

The biomedical/human effectiveness issues associated with Navy aviation are generally in support of a particular operational requirement, weapons systems, or the Naval Aviation Plan (NAP). Appendix F, memoranda from the Assistant for Medical and Allied Sciences (OP-098E) RDT&E to Aircrew Survival Enhancement Program Coordinator (OP-50C) provides aviation biomedical/ human effectiveness input to the NAP.

The categories of RDT&E of major concern to this workshop are 6.1 Research under the cognizance of the Chief of Naval Research, 6.2 Exploratory Development under the cognizance of the Chief of Naval Material/Chief of Naval

Development and 6.3 Advanced Development under the cognizance of the Chief of Naval Operations. Appendix C provides the definition of each of these categories.

Unlike RDT&E categories 6.1 and 6.2 which may not be well defined, RDT&E category 6.3 - Advanced Developments is defined and documented in Navy Decision Coordinating Papers (NDCP's). Appendix G provides the following NDCP's which are of prime concern to this workshop:

Number	Title	Project Manager
M0095 - PN	Fleet Health Technology	CDR James F. Bates, MSC, USN
M0096 - PN	Fleet Health Standards	CDR Robert J. Biersner, MSC, USN
M0097 - PN	Impact Injury Prevention	CAPT Ronald K. Ohslund, MC, USN

These NDCP's provide the basis for the advanced development (6.3) naval aviation biomedicine/human effectiveness effort.

Subordinate to these NDCP's is the research being conducted and described in the various research resumes (1498's) and research summaries. Appendix H provides research resumes (1498's) for all identified new research starts initiated since the FY-74 workshop.

Appendix I, Research Summaries, provides a compilation of research summaries, relevant to this workshop, that are under the cognizance of the Naval Air Development Center. Some of the research described is within RDT&E category 6.4 - Engineering Developments.

Appendix A

Agenda

BRIEFING AGENDA

Thursday - 11 January 1979 and Friday - 12 January 1979

0900 - VIP's

Captain Roger G. Ireland, MC, USN, Workshop

Briefers

- Naval Aviation Plan Captain Hugh F. Lynch, USN
  or Lieutenant Colonel Richard K. Thompson, USMC
- VSTOL/Air Capable Ships Captain Thomas S. Rogers, Jr., USN
- USMC Issues/AV - 8B To be announced
- Attack Aircraft, F/A-18 Captain Jerry C. Breast, USN
- Fighter Aircraft, F-14 Commander Joseph A. Brantuas, USN
- Helicopter, SH-60B Commander Donald G. Richmond, USN
- VS Aircraft, S-3 Captain Anthony W. Stoeckel, USN
- VP Aircraft, P-3/MPA Captain Edwin K. Anderson, USN
- Trainers, T-34C, T-44, VTX None Identified
- SERE/POW Issues Captain Hawkins G. Miller, USN
  and Commander Giles R. Norrington, USN
- Tactical Nuclear Warfare Captain Milton D. Beach, USN
- DIA Overview To be announced

- Closing Remarks/Administrative Details Captain Ireland

* No schedule has been established due to the current uncertainty of the ability of honored guests to attend.

Naval Aviation

Biomedicine and Human Effectiveness

Technical Workshop

Sunday - 14 January 1979

1400 (Front Desk)	Check-in - Room Assignment
	Registration - King James Room
1600-1800	Happy Hour - (Private Room to be announced)
	Free Time

Monday - 15 January 1979

0830 (Conference Room A)	Welcoming Address/Review of FY-74 Technical Workshop Captain Roger G. Ireland, MC, USN, Workshop Chairman
0900	Review of Committee Procedures Captain Ronald K. Ohslund, MC, USN
0930 (Upper Lobby)	Coffee Break
1000	Initial Committee Meetings
	(Conference Room A) A - Life Support and Survival Systems Mr. De Simone - Chairman
	(Conference Room B) B - Physiological Assessment Captain Wenger, MC, USN - Chairman
	(Conference Room C) C - Human Effectiveness Commander Gregoire, MSC - Chairman
	(Tack Room) D - Clinical Aerospace Medicine Captain Lestage, MC - Chairman
1100 (King James Room)	Steering Committee and Committee Chairman Meeting
1200	Lunch

1330-1700	Continue Committee Meetings
1600	Steering Committee and Committee Chairman Meeting
1900-2200	Continue Committee Meetings

Tuesday - 16 January 1979

0830-1200	Continue Committee Meetings
1100 (King James Room)	Steering Committee and Committee Chairman Meeting
1200	Lunch - Unscheduled Time

Wednesday - 17 January 1979

0830 (Conference Room A)	General Meeting Captain Roger G. Ireland, MC, USN Workshop Chairman
0900	Continue Committee Meetings
1100 (King James Room)	Steering Committee and Committee Chairman Meeting
1330-1415	Committee A Presentation
1415-1500	Coffee Break
1500-1545	Committee B Presentation
1545-1630	Committee C Presentation
1630-1715	Committee D Presentation
2000-2200	Continue Committee Meetings

Thursday - 18 January 1979

0830-1000	Discussion: Navy R&D Management Issues Discussion Leaders
1000-1020	Coffee Break
1020-1200	Review of Conclusions and Final Report Captain Roger G. Ireland, MC, USN

Appendix B

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ADDENDUM 18 December 1978

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Appendix C

Definition of Categories of RDT&E

CATEGORIES OF RDT&E

For planning, funding, and review purposes, the Defense RDT&E Program is structured in six categories. In discussion and informal documents these categories are often referred to by the numbers of the categories under the DOD Programming System. The six categories and their numbers are as follows:

6.1 Research - Includes scientific study and experimentation directed toward increasing knowledge and understanding in those fields of the physical, engineering, environmental biological-medical, and behavioral-social sciences related to long-term national security needs. It provides fundamental knowledge for the solution of identified military problems. It also provides part of the base for subsequent exploratory and advanced developments in Defense-related technologies and of new or improved military functional capabilities in areas such as communications, detection, tracking, surveillance, propulsion, mobility, guidance and control, navigation, energy conversion, materials and structures, and personnel support.

6.2 Exploratory Development - Includes all effort directed toward the solution of specific military problems, short of major development projects. This type of effort may vary from fairly fundamental applied research to quite sophisticated breadboard hardware, study programming and planning efforts. It would thus include studies, investigations, and minor development effort. The dominant characteristic of this category of effort is that it be pointed toward specific military problem areas with a view toward developing and evaluating the feasibility and practicability of proposed solutions and determining their parameters. Program control of

the Exploratory Development element will normally be exercised by general level of effort.

6.3 Advanced Developments - Includes all projects which have moved into the development of hardware for experimental or operational test. It is characterized by line item projects, and program control is exercised on a project basis. A further descriptive charateristic lies in the design of such items being directed toward hardware for test or experimentation as opposed to items designed and engineered for eventual Service use.

6.4 Engineering Developments - Includes those development programs being engineered for Service use but which have not yet been approved for procurement or operation. This area is characterized by major line item projects and program control by review of individual projects.

6.5 Management and Support - Includes research and development effort directed toward support of installations or operations required for general research and development use. Included would be test ranges, military construction, maintenance support of laboratories, operations and maintenance of test aircraft and ships, and studies and analyses in support of the R&D program. Costs of laboratory personnel, either in-house or contract-operated, would be assigned to appropriate projects or as a line item in the Research, Exploratory Development, or Advanced Development Programs areas, as appropriate. Military Construction costs directly related to a major development program will be included in the appropriate element.

6.6 Operational System Developments - Includes research and development effort directed toward development, engineering and test of systems, support programs, vehicles and weapons that have been approved for production and

Service employment. This area is included for convenience in considering all RDT&E projects. All items in this area are major line item projects which appear as RDT&E Costs of Weapons Systems Elements in other Programs. Program control will thus be exercised by review of the individual research and development effort in each Weapon System Element.

Appendix D

OPNAVINST 5000.42A

DEPARTMENT OF THE NAVY
Office of the Chief of Naval Operations
Washington, D.C. 20350

OPNAVINST 5000.42A
OP-090/098
3 March 1976

OPNAV INSTRUCTION 5000.42A

From: Chief of Naval Operations
To: All Ships and Stations (less Marine Corps field addressees not having Navy personnel attached)

Subj: Weapon Systems Selection and Planning

Ref:
(a) SECNAVINST 5000.1, System Acquisition (NOTAL)
(b) SECNAVINST 5420.172A, DNSARC (NOTAL)
(c) OPNAVINST 5000.46, DCP and PM Preparation and Processing (NOTAL)
(d) VCNO memo Ser 090/51717 of 30 May 1975 and DEPSECDEF memo dated 30 September 1975 (NOTAL)
(e) OPNAVINST 3960.10, Test and Evaluation (T & E) (NOTAL)
(f) DOD Directive 5000.28, Design to Cost (DTC) (NOTAL)
(g) OPNAVINST 4720.2D, Fleet Modernization Program (NOTAL)
(h) OPNAVINST 4720.9D, Approval for Service Use (NOTAL)
(i) OPNAVINST 4100.3A, Integrated Logistic Support (NOTAL)
(j) SECNAVINST 5200.30, Management of DCPs and PMs within DON (NOTAL)

Encl:
(1) Documentation and Review Procedures: functional diagram
(2) Research and Development Plan
(3) Development Proposal (DP) contents

1. Purpose. This instruction:

a. Amplifies policy set forth in reference (a).

b. Establishes a revised R&D planning procedure.

c. Establishes procedures for identifying operational requirements and conducting management reviews during system acquisition.

2. Cancellation. This instruction cancels and supersedes OPNAV Instruction 5000.42 dated 1 June 1974.

3. Background. Establishment of the CNO Policy and Planning Guidance (CPPG) and the CNO Program Analysis Memoranda (CPAM) process, coupled with the major acquisition policy set forth in reference (a), requires establishment of new procedures and documentation for material development and acquisition in the Navy.

4. Application. The guidance herein applies to all Navy acquisition programs. The guidance herein is also applicable to other Navy programs that are not so designated. Acquisitions to be funded directly from Marine Corps appropriation accounts are not covered under this instruction. Four acquisition categories (ACATs) govern acquisition procedures and responsibilities and assign respective decision authority levels. The following criteria establish policy for the designation of these program categories:

a. ACAT I. In accordance with reference (a), these are SECDEF/DEPSECDEF designated programs, i.e., major programs having an estimated RDT&E cost in excess of $50 million, or an estimated production cost in excess of $200 million, and such other programs as SECDEF/DEPSECDEF designates. Decision authority is the SECDEF/DEPSECDEF. ACAT I programs normally require a Decision Coordinating Paper (DCP).

b. ACAT II.

(1) Other programs designated by the Director, Defense Research and Engineering, or other appropriate principal on the Defense Systems Acquisition Review Council (DSARC). Decision authority is the appropriate DSARC Principal. This type of ACAT II program will normally require a Program Memorandum (PM).

(2) In accordance with reference (b), such programs as the SECNAV may direct. Decision authority is SECNAV. This type of ACAT II program will normally require a Navy Decision Coordinating Paper (NDCP).

(3) Other programs below the ACAT I level which have an estimated RDT&E cost in excess of

$20 million, or an estimated production cost in excess of $50 million, or other programs so recommended by CNO, CHNAVMAT, OP-090, OP-098, or Program Sponsor (DCNO/DMSO). CNO is the decision authority. (NDCP required.)

(4) All ship acquisition programs not requiring DSARC review in accordance with SECDEF/SECNAV agreements arrived at in accordance with reference (d). CNO is the decision authority. (SAIP required in accordance with reference (d)).

c. ACAT III. Programs below the ACAT II level which have an estimated RDT&E cost in excess of $5 million, or an estimated production cost in excess of $20 million, and other lesser programs so recommended by CNO, OP-090, OP-098, or the Developing Agency. The decision authority is the Program Sponsor. Normally programs which will directly and significantly affect the military characteristics of ships, aircraft, or other combatant units and which will require OT&E to support key program decisions or which will require fleet RDT&E support will be designated as ACAT III programs.

d. ACAT IV. Programs not in ACAT I, II, or III. Decision authority is CHNAVMAT or his designated subordinate.

5. Policy. The management principles of reference (a) are applicable to all acquisition programs. The R&D planning and requirements initiation procedures will be in consonance with the foregoing management policy and guidance set forth in the CPPG/CPAM process. ACAT I and II programs shall receive documentation, management and review as described in paragraph 7g. ACAT III and IV programs shall receive analogous documentation, management and review in accordance with procedures established by the cognizant decision authority. At a minimum, documentation for ACAT III and ACAT IV programs will consist of a Navy Decision Coordinating Paper (NDCP) described in paragraph 6h. Program reviews will, among other things, ensure that program structure, affordability and funding adequacy are in consonance with current PPBS documents. T&E results and plans (reference (e)), and Design to Cost (DTC), including life cycle costs (reference (f)) shall be displayed. Development programs of a continuing nature (so called level-funded programs) not suited to key milestone reviews will be considered by the cognizant decision authority in periodic management reviews or within the CPAM process. Minimum documentation shall be a "Mini-MIP"

6. Definitions. Definitions included in references (a) and (c) apply. Enclosure (1) is a functional diagram of the planning, documentation and review procedure. The following additional definitions are provided:

a. CPPG/CPAM. The CNO Policy and Planning Guidance (CPPG) is derived from and transmits the essence of SECDEF's Defense Policy and Planning Guidance (DPPG) as it applies to the Navy, along with CNO's amplification of this guidance. The CPPG provides more specific guidance for the Navy input to the Joint Force Memorandum (JFM) and the Navy input to the Department of the Navy Program Objectives Memorandum (POM). To ensure that Navy programs are fully supportive of national security requirements and foreign and domestic policies, and that internal Navy planning and programming is consistent and coordinated, the CPPG provides planning guidance for the formulation of the CNO Program Analysis Memoranda (CPAM). CPAMs are developed to present the CNO Executive Board (CEB) with an overview of the approved Five Year Program. Each CPAM identifies major issues and alternatives based on considerations of cost and capabilities. Subsequent to CEB review and decision, the CPAMs form the basis for JFM and POM development.

b. Program Decision Authority. That individual responsible for approving program milestones, for conducting program reviews and for authorizing release or withholding of funding support depending upon program progress. He is the authority to arbitrate program matters, recommend changes, and recommend if a higher acquisition category shall be assigned.

c. Resource and Mission Sponsor Plans. Warfare, mission or support plans which contain guidance for introduction of new or modernized systems and set forth user requirement objectives in consonance with the CPPG.

d. Research and Development Plan. The Director, Research, Development, Test and Evaluation prepares

the R&D plan consistent with the CPPG, Resource and Mission Sponsor Plans, Joint Research and Development Objectives Document (JRDOD), etc., which integrates such needs and requirements and establishes broad Navy RDT&E planning guidance. The R&D plan is based upon Science and Technology Objectives (STO) and approved Operational Requirements (OR).

e. Science and Technology Objectives (STO). The STOs describe in broad terms the Navy's needs and problems requiring R&D solutions, and are based on the Navy's role, objectives and threat anticipated in the 10 to 20 year future time frame.

f. Operational Requirement (OR). ORs are concise statements of operational needs (not to exceed 3 pages). The OR is the basic requirement document for all Navy acquisition programs requiring research and development effort. The OR solicits Development Proposals (DP) from the Naval Material Command or Bureaus, as appropriate.

g. Development Proposal (DP). DPs are prepared by the Naval Material Command or Bureaus, and present alternatives and tradeoffs to achieve a particular range of capabilities, in response to the OR.

h. Navy Decision Coordinating Paper (NDCP). NDCPs are documents which support, authorize and promulgate the SECNAV/CNO decisions to initiate development programs and establish appropriate Advanced/Engineering Development line items. Approved NDCPs authorize program starts and subsume associated ORs and DPs. NDCPs will serve as the basis for preparing Decision Coordinating Papers (DCP) for ACAT I programs or Program Memoranda (PM) for programs selected by a DSARC principal. NDCPs, DCPs and PMs have the same basic format as described in reference (c).

(1) NDCPs required for ACAT III and ACAT IV programs shall follow the outline of the DCP/NDCP, except that non-applicable sections may be eliminated or compressed as appropriate. For program developments costing less than $5 million RDT&E, NDCPs shall contain, at a minimum, a description of the program and objective, a plan of action, projected funding profile, risk assessment, and development milestones.

i. Test and Evaluation Master Plan (TEMP). The TEMP is the controlling management document which defines test and evaluation for each acquisition program in ACAT I, II and III. (It is not applicable to ACAT IV). It is prepared in accordance with reference (e) by the Developing Agency in cooperation with COMOPTEVFOR (and PREINSURV when appropriate) and is approved by the CNO. It contains the integrated requirements for development test and evaluation (DT&E) and operational test and evaluation (OT&E).

j. Program Review. The principal means for monitoring acqusiition programs is the Program Review process. Reviews are conducted at levels consistent with the program decision authority for each program. ACAT I programs will be reviewed first at the CNO/SECNAV level, then at the SECDEF/DEPSECDEF level (DSARC process). ACAT II programs will be reviewed by either the DNSARC or CEB/ARC (Acquisition Review Committee). ACAT III will be reviewed by the Program Sponsor (DCNO/DMSO). ACAT IV programs will be reviewed at the NAVMAT level. Paragraph 7g outlines program review procedures.

k. Acquisition Review Committee (ARC). The ARC is a subpanel of the CEB. The ARC exercises the program monitoring responsibility for CNO designated programs. The ARC shall be composed of the Director, Navy Program Planning (chairman), Director, Research, Development, Test and Evaluation, Deputy Chief of Naval Operations (logistics), cognizant Resource and Mission Sponsor(s), CNM representatives, and CMC representatives where appropriate.

l. Ship Acquisition and Improvement Panel (SAIP). For ship acquisition programs, the SAIP shall discharge all the functions normally performed by the ACR in other acquisition programs.

m. Significant Alterations. A significant alteration is any change in design or fabrication that alters substantively the operational, logistic or other military characteristics including reliability and maintainability. Significant alterations are handled in the same manner as acquisition programs.

7. Action

a. Acquisition Review Committee (ARC). The specific activities of the ARC are set forth in subsequent paragraphs. The OPNAV program sponsor in coordination with Director, Navy Program Planning, will schedule and arrange program reviews in accordance with procedures in reference (c).

b. Resource and Mission Sponsor Plans. Each DCNO/DMSO will prepare and maintain (an) annually revised updated plan(s) which set(s) forth, as a minimum, current FYDP approved force levels, FYDP procurements/modification plans, reasonably achievable variations to the FYDP plans, and a 15-year extended mission projections of those plans which will require R&D solutions. The baseline plan will be constrained to the CPPG/CPFG fiscal guidance. The plans should set forth, as concisely and coherently as feasible, the sponsor perceived resource/mission needs necessary to carry out CPPG/CPFG. The plans will serve as the basis for annual CPAM issue paper inputs (and Sponsor Program Priorities (SPP)). The extended, or long-range plans will be a major basis for the R&D Plan.

c. R&D Plan. The Director, Research, Development, Test and Evaluation (DRDT&E) shall prepare and maintain a current Navy R&D Plan which serves as the central repository of research and development planning guidance. The contents of the plan are contained in enclosure (2). The plan will be consistent with the CPPG and CPFG and ensure a balanced effort responsive to mid- and long-range needs. The R&D Plan is developed using the Resource and Mission Sponsor Plans and other requirements, and serves as the primary guide to the research and development community for the establishment of projects which are responsive to operational needs. This R&D Plan will be updated annually and on a continual basis as ORs and STOs are developed. The STOs will enunciate operational problems and thereby provide guidance which may require longer range activity in basic research and exploratory development for solution. The STOs will be promulgated by the DRDT&E to the Chief of Naval Development and the Chief of Naval Research.

d. Operational Requirements (OR)

(1) Submission. ORs will be prepared for all advanced and engineering development requirements (6.3 and 6.4 respectively). Draft ORs are brief statements of operational needs or requirements and may be submitted by any fleet activity or Navy command via the chain of command to the cognizant CNO Resource and Mission Sponsor with a copy to DRDT&E, for entry into the Navy development and acquisition selection process. When ORs are submitted by activities located outside the local Washington area, the originating activity will be informed of the action contemplated by the cognizant sponsor.

(2) Validation and Promulgation. All ORs shall be concurred in by cognizant sponsors and Director, Navy Program Planning, and promulgated by DRDT& ORs which clearly will lead to major weapon system acquisitions, or will require costly R&D programs, or early conceptual effort will be submitted to the CEB/ARC/SAIP for concurrence prior to promulgation. The dollar thresholds established for ACAT I and ACAT II apply. These thresholds do not preclude submission of significant ORs to the CEB, ARC or SAIP which are estimated to be below these prescribed dollar thresholds. Approved ORs will be promulgated by DRDT&E in the format as described in enclosure (2). Current approved ORs will be maintained in the R&D Plan until an NDCP, PM or DCP has been approved for the requirement at which time the OR is subsumed. ORs will be reviewed periodically for continued applicability, revision or cancellation.

e. Development Proposals (DP). The DP formally responds to the OR. The DP will be submitted in accordance with the schedule and special instructions (e.g., reliability and maintainability, manpower and software requirements etc.) contained in the promulgating letter forwarding the OR. It is anticipated that an iterative process will be developed through an informal dialogue between the OPNAV OR sponsor and the CNM to prepare the DP. In the process, CNM should consult with DT&E activities and COMOPTEV FOR (for OT&E) while preparing the initial draft to ensure adequate scheduling and resource allocation is provided for T&E. In this manner, all questions in

relation to the statement of the requirement (OR) and the development of alternatives available to fulfill the requirement (DP) are resolved in the NDCP, including T&E, manpower, personnel and training requirements. The DP is subsumed by an approved NDCP, DCP or PM. The format and content of a DP is contained in enclosure (3).

f. Navy Decision Coordinating Paper (NDCP). The NDCP document defines program issues, the considerations which support the operational need, program objectives, program plans, performance parameters, areas of risk, development alternatives, level of logistic support and relationship to logistic capabilities. The NDCP is prepared and processed for approval in accordance with the procedures described in reference (c). The procedure parallels that used for PMs and DCPs. Draft NDCPs for programs designated as ACAT I and ACAT II will normally be presented for CNO approval at a CEB/ARC/SAIP meeting. If required to further define the program or alternatives, additional (iterative) CEBs, ARCs or SAIPs will be used to develop the CNO decision (preferred alternative). For ACAT III and ACAT IV Navy development programs, an NDCP will be prepared as discussed in paragraphs 5 and 6h.

(1) For designated programs requiring further approval by higher authority, the NDCP approval only authorizes extended systems planning and conceptual effort as defined in reference (a). Until program initiation approval is received at decision Milestone I, such programs will be limited to Navy authorized funding level as identified in the CNO approved program, as ratified by the ASN (R&D). Approved NDCPs shall be promulgated by DRDT&E, at which time ORs and DPs are subsumed. For SECDEF/DEPSECDEF or DSARC Principal-designated programs, the NDCP cover sheet must include the draft DCP or PM title.

g. Program Review and Appraisal. The management principles set forth in reference (a) and the enclosures thereto, establish the concepts of program monitoring for major resource commitments. Principal reviews are held in accordance with procedures set forth in references (a) through (f). Normally, key decision points (milestones) will occur prior to, or coincident with reviews specified in reference (a), i.e., I - Program Initiation, II - Full Scale Development, and III - Production Release. The purpose of such reviews is to resolve any effort on program objectives the development has engendered. Special reviews may be held at any time when other matters jeopardizing project success are perceived which can not be accommodated during normally scheduled program milestone reviews.

(1) For ACAT I programs, Navy program reviews are first conducted by the CEB, and DNSARC to determine the Navy's preferred alternative. ACAT I programs are then reviewed by the DSARC, and program decisions are made by SECDEF.

(2) ACAT II programs are first reviewed within the Navy by the ARC. OP-090, acting for CNO, determines the Navy's preferred alternative. Those programs selected by a DSARC Principal are then reviewed by the DSARC or DOD management review and program decisions are made by the DSARC Principal. Normally, ACAT II programs are reviewed by the ARC, and OP-090, acting for CNO. CNO is the decision authority.

(3) ACAT III programs are reviewed by an OPNAV Review Board with membership designated by the Program Sponsor (DCNO/DMSO). Program decisions are made by the Program Sponsor acting for CNO.

(4) Reviews of ACAT IV programs are as directed by CHNAVMAT, who is the program decision authority for ACAT IV programs.

The primary purposes of program review are:

(1) Program Review I. Program Review I shall be conducted by the CEB/ARC/SAIP/DNSARC and/or the DSARC for programs meeting established threshold criteria. For SECDEF/DEPSECDEF or DSARC Principal-designated programs, the review must meet the requirements of references (b) and (c). Milestone I Review will concentrate on the system characteristics and verify that the requirement deserves the initiation of the financial obligation proposed by the development alternatives.

(2) Program Review II. This Review will normally be held prior to commencing full scale development. The program shall be appraised for operational effectiveness and suitability and assessed for technical and managerial readiness to proceed. This review will be coincident with Program Review I for those prograns which proceed directly into engineering or operational systems development.

(3) Program Review III. Program Review III will be held prior to commencing limited production or full scale production for all designated programs. Program Review III, in particular, shall include sufficient assessment to be sure that the system developed will meet the operational need and is the best achievable alternative, that costs are acceptable in the light of overall force needs and plans, that logistics have been fully provided for (reference (i)), that ship alternatives are programmed in accordance with reference (g) and that the system is indeed ready for major production. Service Approval Board action required by reference (h) should precede Program Review III; however, the full production decision and approval for service use decision may be combined into a single action if practical. Under conditions delineated in reference (h), limited major production may be authorized in advance of service approval.

(4) Lesser Programs. Program sponsors and CHNAVMAT shall establish procedures for the conduct of analogous reviews for ACAT III and IV programs, respectively, in accordance with the policy stated in paragraph 5.

(5) Ship Acquisition Review. For those ship acquisition programs not requiring DSARC review, the SAIP will review the program in accordance with current standing procedures and schedules.

h. Additional Review. In those cases where agreement cannot be reached on program reviews by the ACR or SAIP and when the chairman of the ARC or SAIP considers further review is warranted or when directed by the CNO, the matter shall be referred to the full CEB.

8. **Exploratory Development Transition.** The Chief of Naval Material (DCNM/Development) will establish a mechanism for supplying the CNO with proposed programs based on technology developed in response to the STOs.

9. **Technical Support and Assistance.** Technical support and assistance for the preparation of planning and review documentation throughout the process may be obtained on request to the CNM. Means for accomplishing this support will be negotiated by the responsible DCNOs/DMSOs.

JAMES W. NANCE
Assistant Vice Chief of Naval Operations
Director of Naval Administration

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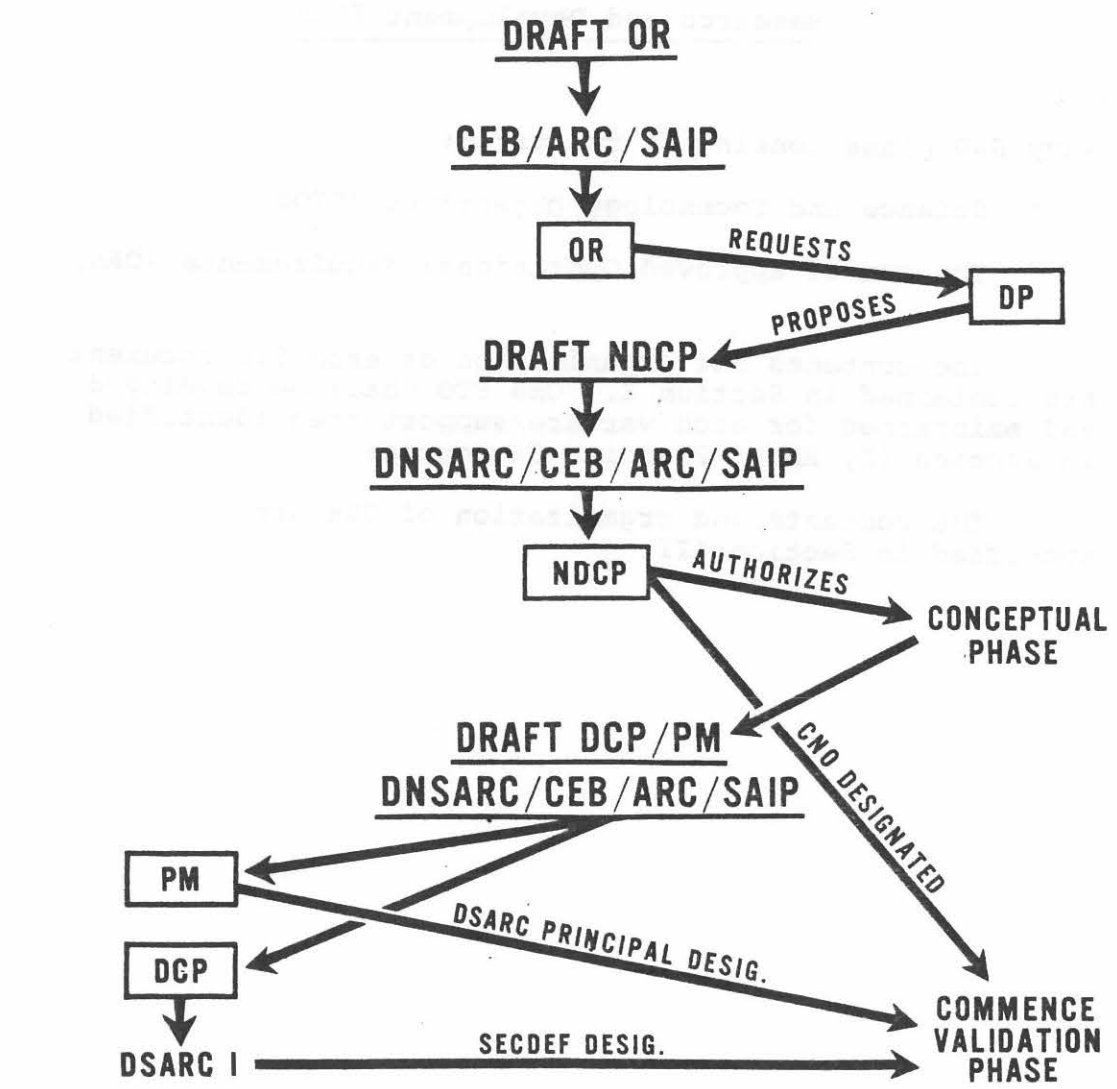

Enclosure (1)

Research and Development Plan

Navy R&D plans consist of two parts:

- Science and Technology Objectives (STOs)
- The sum of approved Operational Requirements (ORs)

The contents and organization of each STO document are contained in Section I. One STO shall be developed and maintained for each warfare/support area identified in Section II, RDT&E Planning Categories.

The contents and organization of ORs are specified in Section III.

ENCLOSURE (2)

Section I

SCIENCE AND TECHNOLOGY OBJECTIVES

TITLE PAGE

LETTER OF PROMULGATION

1. OVERVIEW. (Describe in broad terms the Navy role and objectives anticipated in the particular warfare area in the 10-20 year future time frame).

2. THREAT ENVIRONMENT. (Describe the threat that the Navy anticipates encountering and the needed capabilities to neutralize or overcome such threat in the 10-20 year future time frame).

3. OPERATIONAL PROBLEMS - NEW THREAT RELATED. (Describe broad operational problems).

3.1 Limitations of existing systems

3.2 Capability required

3.3 Importance of effort--criticality

4. RELATED SOURCE DOCUMENTS. (Reference applicable Resource and Mission Sponsor Plans, Technology Coordinating Papers, Area Coordinating Papers, Mission Area Summaries and applicable portions of the JRDOD and any other documents as appropriate).

Section II

RDT&E PLANNING CATEGORIES

I. Strategic Deterrence

- A. Sea-Based Strategic Warfare (SB)

II. Sea Control

- A. Anti-Air Warfare (AA)
- B. Anti-Submarine Warfare (AS)
- C. Anti-Ship Warfare (SH)
- D. Mine Warfare/Mine Countermeasures (MW)

III. Projection of Power Ashore

- A. Amphibious Warfare (AW)
- B. Tactical Warfare Ashore (TW)
- C. Special Warfare (SW)

IV. Mission Support

- A. Personnel/Medical (PN)
- B. Support, Logistics & Underway Replenishment (SL)
- C. Ocean Surveillance (OS)
- D. Command, Control and Communications (CC)

Section III

OPERATIONAL REQUIREMENT (OR)

1. General. The purpose of the OR is to initiate conceptual effort to meet an operational need, focus the effort by establishing parameters for the concept or system envisioned, and solicit DPs from CNM and Bureaus. The OR will be limited to three (3) pages.

2. Contents.

OPERATIONAL REQUIREMENT TITLE

I. OPERATIONAL NEED.

a. Threat. A brief concise statement of opposition forces, time frame and the expected parameters of threat or threat system (secure OP-009 concurrence). Reference to applicable S&T Objective acceptable.

b. Operational Problem. Discuss the deficiency in present capability and consequences of not satisfying the operational problem.

II. OPERATIONAL CONCEPT.

How is system to be used against opposition? Indicate compatibility with other systems or forces, including U.S. Allies. State if employed system destroys, neutralizes, aborts or avoids threat. If appropriate an interim approach toward a final desired solution may be described. Indicate any special logistic and training support considerations.

III. CAPABILITIES REQUIRED.

a. Performance Goals.

(1) OR System Parameters/Criteria. Indicate, using current technological state-of-the-art or considered judgments for the threat period, that criteria anticipated to be available for the OR system, component, support system, etc. These criteria may force some of the technological advances or concepts expected. State the performance goals desired for the development to perform its

intended mission. Specify trade-offs available between performance goals. Performance characteristics which should be considered are range, speed, endurance, flight profile, detection envelope, engagement envelope, maneuverability, information transfer rate, CEP lethality, firing rate, accuracy, reliability, guidance, etc. The OR should state an achievable level of performance below which the development will not be acceptable (floor) so as to preclude the expenditure of funds for marginal increases in capability, and, state a desired performance level (ceiling) suitable to the operational requirement of the system in order to preclude the expenditure of funds for refinement in excess to the operational needs.

(2) Target Parameters Criteria. Indicate from best available sources the characteristics that the threat will present to the system required in the OR. Some of the target parameters which may be specified are range, velocity, endurance, operating modes, countermeasures, guidance, maneuverability, construction, support systems, etc. Target criteria should not be overstated or be in conflict with agreed intelligence (state upper-lower limits).

(3) Operational Employment. Describe natural and opposition environment. State where, how, and under what environmental conditions the capability will be employed, e.g., weather conditions, night/day operation, air/sea interfaces.

b. Manpower and Personnel Considerations. In the design and development of requirements, full consideration should be given to manpower costs and to the feasibility of providing the personnel with the required skills to maintain the installed systems. Provisions should be made to maintain "trade-offs" designed to reduce manpower costs and to simplify operation and maintenance.

c. Reliability and Maintainability. From the outset, planning will accord high priority to simplicity in design and toughness of management, including trade-offs and contractual provisions, to ensure a high degree of reliability and maintainability.

IV. QUANTITIES AND COST OBJECTIVES. Estimate the number of systems likely to be produced in postualated time frames. Preliminary design-to-cost goals should be established.

V. INITIAL OPERATIONAL CAPABILITY (IOC). Fleet introductio

VI. PROPOSED/ESTIMATED FUNDING (FY PLUS 5 YRS) FOR OR.

RDT&E: (6.3/6.4/6.6)
OTHER: (WPN, OPN, SCN, APN)

VII. ON-GOING/RELATED EFFORTS (As of _____)

Activity/Title of effort/funding (as applicable). Indicate whether Navy SYSCOM, lab., etc., and Joint, Army, AF, industry if known or applicable.

VIII. PRINCIPAL WARFARE AREA

(In accordance with Section II)

RELATED WARFARE AREA

(In accordance with Section II)

SECTION IV

DEVELOPMENT PROPOSAL (DP) CONTENTS

PROGRAM TITLE

I. Background

State need extracted from the Operational Requirement (OR) or Resource/Mission Sponsor plan, as appropriate. Expand if appropriate. State need in positive terms. Do not state deficiencies in current operations, tactics, or systems. Indicate need in appropriate time frame. Use simple, terse, concise language. Do not use verbose "boiler-plate" descriptions.

II. Issues

Initiate conceptual, advanced or engineering development.

Point-out other key issues (joint programs, costs, schedules, Congressional impact or actions, changes in threat, etc.)

III. Requirement and Program Objectives

State how recommended alternative(s) and/or objective(s) satisfy(ies) the operational need.

IV. Program Alternatives

Describe alternative approaches investigated. Indicate relevant, previous test results. Show comparative advantages/disadvantages of each significant or reasonable alternative considered. Describe logistic support approaches, identifying significant impact on personnel skill levels and numbers. Provide rationale for selected proposed approach.

V. Effectiveness and Cost Comparison of Alternatives

Indicate as applicable: Estimated development cost and cost-time profile; estimated unit cost of production model (design-to-cost); estimated development/production schedules; indicate risks of failure with respect to perfromance, military

value, cost and schedule; relation to Hi/Lo mix and expected utilization in fleet modernization and future ship and aircraft classes/types/models; estimated degree of relative improvement over existing systems.

VI. Risks

List and explain critical performance tests during development. Cite uncertainties to be resolved, including relative performance risk, cost, and schedule risks.

VII. Test and Evaluation

Propose program performance criteria, indicating achievement oriented performance objectives and provide a recommended test plan to evaluate progress. Test proposal should include operational as well as developmental testing.

VIII. Other Factors

Indicate other factors which will impact on the effective introduction of this system, i.e., logistics, training, support, environmental impact and human resources, etc.

Indicate other on-going or proposed related programs and the interface of this proposal to other programs. Include Navy, Joint Service, Army, and Air Force programs/projects.

IX. The Development Plan(s) Achievement Milestones and Thresholds

Indicate RDT&E milestone schedule and recommend category (6.3, 6.4, or production). Critical logistics milestones (manual, test equipment verification, and test leading to approval for service use) shall be included, if available.

X. Approval

Each DP will contain an approval/disapproval page(s) which will conform as near as practical to a DCP approval/ disapproval page(s) form.

Appendix E

Extract from the Science and Technology Objectives (STO)
Master Document

11. (U) PERSONNEL/MEDICAL OPERATIONAL PROBLEMS (U)

11.1 (U) Personnel/Medical Task Support (U)

(U) Personnel/medical support contributes to all naval tasks by ensuring that adequate manpower is available and that the health, performance, and motivation of that manpower is optimized.

(U) The objectives of personnel/medical task support are to:

a. Improve manpower planning and requirement determinations, personnel recruitment, selection, training, assignment, and retention

b. Advance human-factors engineering technology and its application in system design

c. Maintain high levels of effectiveness in personnel and organizations

d. Achieve advances in medical and biomedical techniques that enhance personnel readiness and effectiveness

e. Ensure and extend high standards in naval health care.

11.2 (U) Format (U)

(U) THe personnel/medical operational problem statements are organized as shown in Table 11-1. The original page numbers of problems that were addressed in the STO-PN, promulgated 10 July 1975, are shown in parentheses in the page number block.

Table 11-1. (U) Index of Personnel/Medical Operational Problems (U)

PROBLEM STATEMENT AND PAGE NUMBER	SUBJECT
Category A: Personnel	
11-A-1	Predicting Personnel Supply and Management Demand
11-A-2	Lateral Acquisition of Skilled Personnel
11-A-3	Effect of Changing Social Patterns
11-A-4	Selection and Classification
11-A-5	Reserve Forces
11-A-6	Reduction of Personnel Requirements
11-A-7	Equality of Opportunity
11-A-8	Increased Utilization of Women
11-A-9	Utilization and Productivity
11-A-10	Organization Design and Effectiveness
11-A-11	Effectiveness of Nonmonetary Incentives
11-A-12	Management Decision Making
11-A-13	Reduction in Attrition
11-A-14	Personnel Requirements for Special Warfare
Category B: Training	
11-B-1	Training Practices
11-B-2	Graduate Proficiency as Related to Readiness
11-B-3	Training and Education Delivery Systems
11-B-4	Career Programs
11-B-5	Retraining Personnel in New Skills
11-B-6	Technology
11-B-7	Instructor Competency
11-B-8	Decision Making in the Management of Training
11-B-9	Forecasting Requirements for Training in New Technologies
11-B-10	Capitalizing on Differential Aptitudes
11-B-11	Improved Basic Skills
11-B-12	Measuring the Cost and Effectiveness of Training

Table 11-1. (continued)

PROBLEM STATEMENT AND PAGE NUMBER	SUBJECT
Category B: (cont'd)	
11-B-13	Measuring the Productivity of the Training Establishment
11-B-14	Crew, Group, Team, and Unit Training
11-B-15	Energy Conservation Through Substitution of Shore-Based Training
11-B-16	Training and Motivational Techniques for Energy Conservation
11-B-17	Skill Retention by Naval Reserve Personnel
11-B-18	Simulation Technology
11-B-19	Simulation of Explosive Ordnance Delivery
11-B-20	Computer Simulation for Maintenance Training
11-B-21	Visual/Motion Simulation
11-B-22	Displays for Training Devices and Maintenance Job Aids
Category C: Human-Factors Engineering	
11-C-1	Safety and Performance
11-C-2	Tradeoffs Among Selection, Training, and Equipment Design
11-C-3	Simulation of Human Performance for Design Purposes
11-C-4	Performance Evaluation
11-C-5	Human Information Processing
11-C-6	Evaluation of Improvements in Habitability
11-C-7	Design for Maintainability
11-C-8	Streamlining Work Procedures
11-C-9	Interpreting Information from Sensors
11-C-10	Human Aspects of Remotely Controlled Systems
11-C-11	Motion Effects on Personnel
11-C-12	Interactive Voice Technology
Category D: Biomedical Support	
11-D-1	Occupational Safety and Health
11-D-2	Physical and Mental Fitness

Table 11-1 (continued)

PROBLEM STATEMENT AND PAGE NUMBER	SUBJECT
Category D: (cont'd)	
11-D-3	Trauma and Casualty Care
11-D-4	Infectious Disease Prevention and Treatment
11-D-5	Dental Health
11-D-6	Fitness Standards and Screening

BIOMEDICAL SUPPORT: Occupational Safety and Health (U)

PROBLEM STATEMENT:

(U) Environmental stresses, such as noise, thermal extremes, toxic chemicals, pressure, motion, and radiation are necessarily a part of naval systems and platforms and often pose a threat to the health and performance of personnel. Failure to provide adequate protection for personnel in naval workspaces, ashore and afloat, can result in costly constraints to fleet-support operations as well as a decrease in the effectiveness of operational missions. Moreover, personnel are often subjected to psychological stresses in extended operational developments (e.g., submarines) and throughout a naval service career. In order to increase the effectiveness of the individual's job performance, personnel must be optimally protected from the deleterious effects of these stresses.

See also 12-B-10, 12-D-4, 12-G-10, 12-G-14.

CABABILITY REQUIRED:

(U) Protection of personnel from environmental stresses resulting from short- and long-term exposures to high-performance air, surface, and subsurface platforms, thereby ensuring maximum combat effectiveness.

(U) Accurate assessment of man's tolerance to chemical and physical hazards encountered in naval environments and safe-exposure limits consistent with pertinent safety standards.

(U) Effective measures for personnel protection, incorporated into the planning and development of new weapons systems, ships, and shore-based facilities.

(U) Precise information on kinds, directions, frequencies, intensities, and time duration of motions that produce adverse medical, physiological, and performance effects and the time course of these effects, including adaptation, tolerance, and modification.

PRIORITY:	PROBLEM AND PAGE NUMBER:	DATE:
CRITICAL	STO-PN 11-D-1 (3-BMS-1, 3-BMS-5)	July 1977

BIOMEDICAL SUPPORT: Physical and Mental Fitness (U)

PROBLEM STATEMENT:

(U) Many fleet tasks involve extended, continuous operations wherein varied work schedules, workloads, and conditions of sleep loss are common. Such tasks may be degraded if the stress tolerance level of the individual or group of individuals involved is such that their performance is impaired. More often than not, such conditions of duty are determined by custom rather than scientific criteria validated against health or performance deficiency. With increased requirements for technical work to be performed reliably, under reduced manning levels in fleet systems, this problem will be more acute than ever before.

CAPABILITY REQUIRED:

(U) Technologies for use in the diagnosis of stress and fatigue, for screening of susceptibles, and for the rapid acclimatization of personnel to changes in schedule or environment. Definition of adequate periods and conditions for rest and recovery, and application of such knowledge and techniques to shore and fleet operations.

PRIORITY:	PROBLEM AND PAGE NUMBER:	DATE:
HIGH PRIORITY	STO-PN 11-D-2 (3-BMS-2)	July 1977

BIOMEDICAL SUPPORT: Trauma and Casualty Care (U)

PROBLEM STATEMENT:

(U) Traumatic injury is a major cause of death and disability among naval personnel engaged in fleet operations during times of war or peace. There is a vital need to develop improved technology for the care and management of severely injured casualties so as to reduce mortality rates and hospitalization time. This is especially critical under conditions of limited manpower availability, both in terms of limited troop strengths and the shortage of medical, professional, and technical personnel.

See also 8-A-15, 8-A-16.

CAPABILITY REQUIRED:

(U) Improved initial care and management of battle casualties with emphasis on sepsis and pulmonary complications. More effective transplantation and reparative surgery techniques to shorten return-to-duty time.

PRIORITY:	PROBLEM AND PAGE NUMBER:	DATE:
HIGH PRIORITY	STO-PN 11-D-3 (3-BMS-3)	July 1977

BIOMEDICAL SUPPORT: Infectious Disease Prevention and Treatment (U)

PROBLEM STATEMENT:

(U) Infectious disease has been the major cause of man-days lost in all wars and will continue to be a debilitating factor working against the maintenance of high levels of combat readiness. As the operational activity of the Navy becomes more intensive and widespread, the chance of exposure to infectious agents will increase.

See also 8-A-16.

CAPABILITY REQUIRED:

(U) Technologies to forecast infectious disease risks for all regions of the world and for subsets of the naval service population at any time; effective methods for the diagnosis, prevention, treatment, and control of infectious diseases that have a major known or potential impact on military operations.

PRIORITY:	PROBLEM AND PAGE NUMBER	DATE:
CRITICAL	STO-PN 11-D-4 (3-BMS-4)	July 1977

BIOMEDICAL SUPPORT: Dental Health (U)

PROBLEM STATEMENT:

(U) The lack of meaningful dental health standards for enlistment permits a hugh dental disease liability to enter the Navy each day. This situation, coupled with the extent of new disease occurence in the " career" forces, creates treatment requirements that cannot be met completely with current Dental Corps resources. A recent survey of 500,000 dental records indicated that 15 percent of the Navy's population is affected with dental disease of such severity that it could compromise performance effectiveness.

See also 8-A-16.

CAPABILITY REQUIRED:

(U) Understanding of the dental disease processes encountered in Navy and Marine Corps populations to permit cost-effective prevention measures to be developed. A knowledge base to develop nontraditional, rapid, and safe treatment methods that will permit limited resources to provide complete dental care to all eligible beneficiaries.

PRIORITY:	PROBLEM AND PAGE NUMBER:	DATE:
PRIORITY	STO-PN 11-D-5 (3-BMS-6)	July 1977

BIOMEDICAL SUPPORT: Fitness Standards and Screening (U)

PROBLEM STATEMENT:

(U) Successful accomplishment of fleet tasks depends on the ability and the physical and psychological fitness of the operating personnel. The cost and effectiveness of both training and fleet operations are, fpr the most part, dependent on the quality of the biomedical screening of applicants. Improved job-related screening techniques are needed to ensure that all accepted applicants are fit for duty. Increased complexity of naval systems, capable of operating under all weather conditions, increase the acuteness of this problem.

CAPABILITY REQUIRED:

(U) Technologies and specialized testing devices that accurately assess the sensory, mental, and physiological properties required for effective performance in the fleet. Fair and effective standards, applicable to women and minority groups, which will become an increasingly significant element in the operational Navy.

PRIORITY:	PROBLEM AND PAGE NUMBER:	DATE:
HIGH PRIORITY	STO-PN 11-D-6 (3-BMS-7)	July 1977

Appendix F

Memoranda Providing Aviation Biomedicine/Human Effectiveness Input to the Naval Aviation Plan (NAP)

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

IN REPLY REFER TO

Memo #098E/123-78

23 OCT 1978

MEMORANDUM

From: OP-098E/OP-931D

To : OP-50C

Subj: Aviation Biomedical Research Program Input to the Naval Aviation Plan.

1. Biomedical RDT&E in Support of Naval Aviation Planning throughout the current FYDP and the subsequent fifteen out-year time frame will address the following four major objective thrusts:

a. Quantification of the physiology of stress in the aircrew environment.

b. Development of a biodynamic data base defining aircrew response in force-field environments.

c. Broadened understanding of the sensory and motor nervous system physiology as related to enhancement of aircrew performance.

d. Expanded practical human factors engineering interpretation of the man-machine interface.

2. These planning objectives have been coordinated with the office of the Surgeon General, the office of Naval Research, the Naval Air Systems Command and the Naval Medical Research and Development Command.

R. G. IRELAND
CAPT, MC, USN
ASSISTANT FOR MEDICAL AND ALLIED SCIENCES

Copy to:
OP-093/BUMED Code-5/NMRDC Code-00/
ONR Code-100H/NAVAIR Code-531/
NAVAIR Code-340

MEMO

098E/129-78 NOV 0 1 1978

UNITED STATES GOVERNMENT

memorandum

DATE: Memo #098E/128-78
31 October 1978

REPLY TO ATTN OF: OP 098E/931D

SUBJECT: Aviation Biomedical Research Program Input to the Naval Aviation Plan (NAP)

TO: OP-50C

Ref: (a) Memo 098E/123-78 dated 23 Oct 78 same subject.

1. It is desired to take this opportunity to express a position statement on Planning Objectives for Biomedical RDT&E requirements in the next edition of the NAP as it is in the process of being updated from the 30 Mar 78 Edition. Reference (a) announced the intention to do this and listed four major RDT&E objective thrusts. This follow up memo develops the descriptive language for each objective and replaces each of the statements of reference (a). The internal coordination required was described in this earlier memorandum.

2. Part IV, Paragraph D of the 30 Mar NAP addresses "Researchand Development Objectives". Attention is invited to subparagraph e."Aviation Support". Note that items (6) through (9) deal with an overview of R & D objectives related to personnel life support equipment, protective clothing and escape systems in the context of the aviation operational environment. These are still considered to express valid requirements equated to correction of recognized deficiencies.

3. CONSPICUOUS BY ITS ABSENCE is a statement of R & D objectives related to the Biomedical Technology Base required to support these life support systems hardware development goals and to support the optimization of "man in the system" in aviation operations in general. To address this deficiency in the NAP it is desired to augment subparagraph e.by the addition of the following four items which identify these Biomedical Technology Base Requirements:

a.(Re: "Quantification of the Physiology of Stress in the Aircrew Environment")

The operational environment always imposes a multiplicity of physical stressors upon the crewman, never a single stress. Past R & D effort has assessed the single stress situation. A requirement now exists to identify and measure the physiological

ENCLOSURE (2) memo
098E/129-78 NOV 01 1978

responses of aircrews exposed to combined stress in a form applicable to models of optimum crew performance within safe limits. Quantifiable response information would serve as a basis for predictive indices of impending failure and be used to establish physical and psychological conditioning programs and work procedure guidelines.

b.(Re: "Development of a Biodynamic Data Base Defining Aircrew Response in Force-Field Environments.")

Existing criteria for aircrew tolerance to inertial forces in the motion environment are often empirical and sometimes based only on catastrophic failure end-points. Systematic, precise multi-axis measurement of human response to the acceleration force-field spectrum is essential to establish the thresholds for temporary crew incapacitation, physical injury and fatality, particularly in crash-impact events. This Biodynamic or human response data base, now obtainable with current technology, is required to finally validate all models for crew tolerance throughout the airborne platform motion range and for test and evaluation of all crew restraint, protective and escape systems.

c.(Re; "Broadened Understanding of the Sensory and Motor Nervous System Physiology as Related to Enhancement of Aircrew Performance")

A requirement exists for more detailed insight into the human internal processing of sensory system inputs and translation into the command and control motor nerve output function. Modern electronic signal processing and computer technology provide a powerful research capability for increasing this understanding of human nervous system physiology. This knowledge eventually would be applicable to hardware systems for signal processing of both sensory inputs and motor drive outputs and for modelling of systems to enhance overall crew performance.

d.(Re: "Expanded practical Human Factors Engineering Interpretation of the Man-Machine Interface")

Inadequate early planning attention to the crew operator's station in design of sophisticated aircraft and weapons systems can degrade the optimum usefulness of the operator in the final systems beyond full correctibility by costly retrofit engineering. There is a critical requirement for early precise information about the operator's body dimensions, strength, coordination and functional limitations in the proposed crew space together with careful selection of the best available display and control technology to

enhance his habitability and performance. This information base must be provided in direct engineering terminology translatable to and capable of driving the design process while it is still flexible.

4. Serious attention to and resources planning support of these four Biomedical Technology Base R&D objectives is essential to successful achievement of the personnel life support hardware objectives and to their test and evaluation phase. Pursuit of the Biomedical Technology Base R&D will have a further favorable influence on the quality of personnel selection and training programs and upon the operational commander's policy guidance for the optimum use of his personnel resources.

R. G. Ireland
CAPT, MC USN
Assistant for Allied &
Medical Sciences

Copy to:
OP-093/Bumed Code-5/NMRDC Code-00
ONR Code-100H/NAVAIR Code-531/NAVAIR
Code-340/OP-59C

Appendix G

Navy Decision Coordinating Papers (NDCP's)
M0095-PN Fleet Health Technology
M0096-PN Fleet Health Standards
M0097-PN Impact Injury Prevention

NDCP - M0095-PN

22 February 1977

NAVY DECISION COORDINATING PAPER

FLEET HEALTH TECHNOLOGY

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

IN REPLY REFER TO

Ser 987/139736
22 FEB 1977

From: Chief of Naval Operations
To: Chief, Bureau of Medicine and Surgery

Subj: Navy Decision Coordinating Paper, Fleet Health Technology (NDCP-M0095-PN)

Ref: (a) OPNAVINST 5000.42A of 3 Mar 1976; Subj: Weapon Systems Selection and Planning

Encl: (1) NDCP for Fleet Health Technology (NDCP-M0095-PN)

1. The Navy Decision Coordinating Paper (NDCP) for Fleet Health Technology is hereby promulgated and is forwarded as enclosure (1).

2. This NDCP has been prepared based upon inputs provided by the iterative process between the Bureau of Medicine and Surgery program representatives. The document provides the program approval authorization for the Fleet Health Technology Program, as stated in reference (a).

P. B. ARMSTRONG
Director
Research, Development, Test and Evaluation

Copy to:
(See next page)

Copy to:

21A	(FLEET COMMANDERS-IN-CHIEF)
22	(FLEET COMMANDERS)
24A	(FLEET AIR FORCE COMMANDERS)
24D	(SURFACE FORCE COMMANDERS)
24E	(COMMINWARCOM) (CODE 005)
24G	(SUBMARINE FORCE COMMANDERS)
28G1	(COMSURFWARDEVGRU)
A1	(ASN(R&D)) only
A2A	(CNR) only
A4A	(CHNAVMAT) (MAT 0301, 03T2, 0313, 036)
A6	(CMC)
C4F9	(NAVSURFWPNCENLAB, WHITE OAK)
E3A	(NRL) (Codes 4105, 7930) only
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FKA1F	(COMNAVSUPSYSCOM)
FKA1G	(COMNAVSEASYSCOM) (SEA 0313)
FKA51A	(NAVAIRDEVCEN)
FKA6A16	(NAVPERSRANDCEN)
FKA6A2	(NAVWPNCEN)
FKA6A3A	(DTNSRDC) (Code 5220)
FKA6A3B	(NAVCOASTSYSLAB)
FKA6A9	(NAVSURFWPNCEN) (WE-02)
FKA6A10	(NELC)
FKA6A11	(NAVUSEACEN)
FKA6A15	(NUSC NPT)
FT1	(CNET)
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Others:

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ASAF(R&D)
DDR&E
NSA (CODE S44) (3 copies)
DEFENSE MAPPING AGENCY
OPA

OPNAV:

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090N	095	980	991	02	32	50	63
094	951	981	992	21	34	51	64
941	953	982	009	22	35	55	
942	955	983					

NDCP# M0095-PN
Program Element 63706
ACAT III
OPNAV Action Officer
CAPT R.G. Ireland, (MC) USN
OP-098E
Project Manager
LCDR J.C. BOND (MSC) USN

NAVY DECISION COORDINATING PAPER

FLEET HEALTH TECHNOLOGY

I. BACKGROUND

Advanced Medical Development is an ongoing technology-base program in Navy RDT&E. Program content generally evolves from the Research and Exploratory Development phases of Medical R&D. Prior guidance provided by General Operational Requirement (GOR) 43, Personnel, and now by Science and Technology Objective Personnel/Medical (STO-PN), initiates efforts in areas of interest which subsequently become inputs to the Program structure. Thus promising technological approaches with Sea-Service applicability are further refined and tested in response to projected military medical requirements of future and potential combat arenas.

This document consolidates project efforts formerly included in Advanced Development Objective (ADO) 43-05, Advanced Medical Development; ADO 43-11, Amphibious Warfare Medical Support; and ADO 43-18, Trauma Care System, in order to provide a viable, dynamic, and responsive Fleet Health Technology Development Program.

II. REQUIREMENTS AND PROGRAM OBJECTIVES

The primary mission of the Medical Department is that of achieving and maintaining physical and mental combat readiness of personnel and providing medical support. This mission must be achieved under the

contingencies of peacetime defense posture and those of warfare. It is under the latter conditions that medical support becomes most critical. On both an historical and prospective basis, disease and injury are the leading causes of personnel incapacitation, in many instances resulting in the loss of entire units of personnel. This can result in mission abortion, a consequence of strategic significance in future conflicts.

In support of the Medical Department mission, advanced development of fleet health technology is dedicated to the objectives of prevention, treatment, and management of disease and trauma injury casualties. Such capabilities must be responsive to the threats imposed by naval service presence in all geographical regions of the world and under a variety of combat conditions.

To counter the thrust of infectious diseases, development of prevention technologies is the primary objective. Such technologies are both feasible and highly cost effective. Secondary to prevention is the objective of developing treatment techniques capable of arresting the severity of disease states and of rapidly restoring personnel to functional duty status. The more specific technologies for disease prevention are those of vector (disease transmitter) control and vaccine development while those of treatment are rapid and accurate diagnostic techniques and drug evaluation. The Navy's current thrust in antimalarial vaccine development is an example of prevention technology against a disease which in the past has been a major threat to combat personnel in tropical areas. In recent years the problem has been intensified by the appearance and spread of drug resistant strains of the malaria parasite. Malaria is but one of the many current and potential disease threats to naval service personnel.

The immediate objective in countering the threat of traumatic injury sustained from fleet operations is that of ensuring that no casualty who survives to reach a medical facility should die from his injury. The ultimate objective is to restore that individual to functional duty status as rapidly as possible. Care of the wounded casualty requires a system of echeloned treatment which under conditions of combat must be logistically feasible within constraints imposed by parameters of operational engagement. The treatment rendered at the site of injury, and at each successive echelon of treatment, is of consequence to the subsequent echelons and to the final outcome of casualty recovery. The major components of casualty management systems are thus interdependent and represent a continuous chain of evacuation and treatment. Across these echelons there must be standardization of diagnostic and surgical procedures for the management of mass casualties, improved techniques for rapid physiological stabilization prior to evacuation, procedures to prevent shock and wound infection, selective treatment methods for the variety of possible wounding agents, and an integrated system of medical equipment, evacuation modes, and treatment facilities.

The requirement for new advanced technologies for prevention and treatment of disease and injury among fleet personnel is especially critical under conditions of limited manpower availability, both in terms of limited troop replacement strengths and the shortage of medical professional and technical personnel.

III. PROGRAM ALTERNATIVES

Options available to the Medical Department in developing disease and injury prevention and treatment capabilities are essentially of three types: (1) transfer of technology from the civilian medical com-

munity, (2) iterative improvement of current military capabilities, and (3) development of new technologies for fleet health care.

Though in selected instances civilian technologies can be functionally adapted to the requirements of military medicine, dependence upon such a source of technologies is not realistic. Medical technologies applicable to military operations, particularly those of combat, are not generally required or advanced by the civilian community. The infectious diseases of greatest risk in combat operations, for example, are not those most prevalent in this country and therefore receive relatively little attention by civilian medical institutions. Similarly, the civilian community has minimal requirements to develop trauma casualty management techniques which are essential under conditions of combat and which must be organized in hostile environments remote from sophisticated medical facilities. Furthermore, the types of trauma injury most common among civilian populations are different from those sustained in combat.

The iterative improvement of existing capabilities for prevention and treatment of disease and injury is a short-term option of demonstrated pay-off. The liability of this option is that it is not essentially responsive to the prevention and treatment of new strains of disease or types of wounds and is less likely to be useful under conditions of fleet operations or warfare scenarios which the Medical Department must be prepared to meet in the future.

The development of new advanced technologies has the potential advantage of improved flexibility and increased efficacy of use, but requires longer lead-times at greater cost. However, this option will ultimately have the greatest impact on the entire system of prevention

and echeloned management of casualties.

In balance, the advanced development strategy of the Medical Department in fleet health technology is that characterized by a mix of these three options, with somewhat more emphasis under current resource constraints on the iterative improvement of current technologies and least dependence on technology transfer from the civilian community. With increased resources, the development of new advanced technologies can be considered more feasible for increased emphasis in the future.

IV. RISKS

The risk of investment varies depending upon the particular advanced development objective being addressed. For example, the risk in developing a remote medical diagnostic system is relatively minimal in comparison with the risk of developing a universal donor type blood or effective limb transplantation technology. Similarly, iterative improvements of current vaccines for preventing specific diseases are lower in risk than the development of a new vaccine capable of countering disease strains with which we have had little experience.

In regard to both disease and injury prevention and treatment technology development, the investment costs of resources and time are high compared to other medical developments, but the potential return on investment is greater. For example, approximately 360,000 units of blood were sent each year to Vietnam, at a collection cost of about $2.5 million. The wastage rate from outdating was about 50%. Development of methods to store red blood cells indefinitely using freeze preservation technology and the ability to biochemically modify and rejuvenate outdated red blood cells could result in a significant cost savings, as well as enhance the ready availability of blood products.

V. OTHER FACTORS

The project presents no adverse environmental impact. Technology transfer is enhanced by the fact that the advances are of value not only to military medicine but to the civilian medical community as well.

VI. RESOURCE AND DEVELOPMENT PLANS

The estimated costs for achievement of the program objectives are shown in the resource plan, Table I.

Major program thrusts leading to the development of new and/or improved Fleet Health Technologies are depicted in Table II, the Program Development Plan.

VII. DESIGN TO COST - Not applicable

VIII. TEST AND EVALUATION

Not applicable in "Hardware Sense". However, appropriate test and evaluation techniques are employed for scientific validation in each sub-project area. For example, in the development of new medical equipments, vaccines, and treatment procedures, different test and evaluation techniques are required and utilized.

IX. MANAGEMENT

The program is managed by the Naval Medical Research and Development Command with close liaison and advice from the Bureau of Medicine and Surgery, Headquarters, Marine Corps and other Navy organizations. Individuals responsible for program management and scientific monitoring are:

Director, RDT&E, N	Program Sponsor
DCNO Logistics (OP-04)	Mission and Resource Sponsor
CAPT. R.G. Ireland, MC USN	OPNAV Dev. Coordinator

CAPT C.K. Wallace, MC USN	Infectious Disease Program
CAPT H.J. Keene, DC USN	Dental Health Program
LCDR J.C. Bond, MSC USN	Fleet Health Care Program

Technical work conducted by contract will be under the contractual management of ONR Codes 443 and 444.

Decisions concerning program direction and funding are made by the program managers based on the recommendations of consultants having technical or operational expertise in various aspects of the program. Periodic review of requirements and priorities as well as program coordination between the military services and other government agencies are accomplished through technical working groups, technical coordinating papers and joint medical research conferences.

In-house laboratories and contractors report by means of annual status reports, technical reports or scientific publications at the conclusion of major phases of work, formal presentations at scientific meetings, and by informal discussion at site visits. Program management prepares formal reporting documentation as necessary and presents briefings as requested.

X. SECURITY

The requirement for and all of the technologies developed in response to this requirement are unclassified and are releasable on a need to know basis.

XI. REVISION

This NDCP will be reviewed annually and updated as deemed appropriate.

TABLE I

PROGRAM RESOURCE PLAN
($ in M)

Program Element: 63706N Title: Advanced Medical Development

Projects:	FY 76	FY TQ	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82
Fleet Health Technology M0095-PN	3.5	1.0	4.6	4.9	5.1	5.3*	5.4*	5.5*
Fleet Health Standards M0096-PN	0.7	0.2	0.7	0.7	0.7	0.7	0.7	0.7
Input Injury Prevention M0097-PN	1.4	0.3	1.2	1.3	0.9	0.7	0.4	-
	5.6	1.5	6.5	6.9	6.7	6.7*	6.5*	6.2*

*Includes $0.9M, $1.1M and $1.2M for continuations of efforts relating to Medical Support Systems (formerly M0096).

TABLE II

PROGRAM DEVELOPMENT PLAN

Program Plan Thrusts for the Development and/or Improvement of Fleet Health Technologies

A. Operational/Combat (Trauma) Injury Management

1. Resuscitation and Management of Casualties:

(Programs in process of completion)

a. Improvement of cardiovascular function and tissue oxygenation during hemorrhagic shock following transfusion of red cells with enhanced oxygen carrying ability.

(Programs in FY 1977)

b. Complete clinical evaluation of crystalloid and saline solutions for resuscitation and treatment of trauma victims.
c. Investigation of various blood borne humoral mediators in the pathogenesis of septic shock.

(Programs in FY 1978)

d. Continue study of body salt and water balance during heat stress.

(Programs in FY 1979)

e. Complete long term studies to assess risk to Navy personnel caused by red-cell glucose-six-phosphate dehydrogenase deficiency.
f. Continue development of diagnostic and treatment methods resulting in improved pulmonary function after traumatic injury.

2. Blood Component Preservation and Therapy

(Programs in process of completion)

a. Demonstration of effectiveness of freeze-preserved platelets in the clinical treatment of blood disorders.

(Programs in FY 1977)

b. Continuation of evaluation of freeze-dried blood components.

(Programs in FY 1978)

c. Determine the clinical acceptability and efficacy of rejuvenated red blood cells.
d. Begin studies to determine efficacy of component blood replacement in terms of platelet function and clotting activity.

(Programs in FY 1979)

e. Begin clinical studies to determine effectiveness of freeze-preserved white blood cells in treatment of systemic infections.

3. Reparative Surgery and Transplantation

(Programs in process of completion)

a. Demonstration of ability to perform successful bone marrow transplantation.
b. Successful use of allogeneic freeze-dried human bone and skin grafts in oro-facial surgery.
c. Demonstration of clinical effectiveness of freeze-dried cartilage for repair of damaged joints.

(Programs in FY 1977)

d. Evaluate non-precious metal alloys for precision dental restoration.
e. Develop and evaluate new methods to prevent and treat graft vs. host disease following bone-marrow transplantations.

(Programs in FY 1978)

f. Initiate two year study to evaluate newly developed synthetic wound covering for treatment of serious burns.
g. Evaluate dental implant materials, designs and surgical techniques.
h. Continue to evaluate methods to reduce graft rejection in tissue transplants.

(Programs in FY 1979)

i. Initiate development of methods to enhance nerve regeneration and repair following traumatic injury to peripheral nerves.
j. Determine the value of bone-marrow transplantation for treatment of radiation injury.

4. Medical/Dental Equipment and Facilities

(Programs in process of completion)

a. Demonstration of effectiveness of repellant impregnated bed nets and wide mesh jackets against insect disease vectors in Africa.
b. Complete test and evaluation of cardio-vascular index computer for assessment of response in working subjects.
c. Complete shipboard feasibility testing and proceed to final prototype testing (1978) of remote medical diagnosis and communications system.
d. Develop design criteria and specifications and proceed to prototyping (1977) and operational test and evaluation (1979) of a modular shipboard laboratory system.
e. Complete study and define requirements for an improved medical/dental command, control and communication system for fleet use.

(Programs in FY 1977)

f. Complete development of new design criteria for shipboard medical spaces.

(Programs in FY 1978)

g. Complete operational test and evaluation of a portable life support stretcher unit.

(Programs in FY 1979)

h. Continue development of new biomedical equipment and technologies for improved health care delivery systems.

B. Prevention and Treatment of Infectious Disease

1. Vaccine Development

(Programs in FY 1979)

a. Commence advanced development of malaria sporozoite vaccine.

2. Disease Vector Control

(Programs in FY 1977)

a. Conduct field tests of selected insect repellants for tropical disease vectors.

3. Rapid Diagnosis

(Programs in FY 1979)

a. Develop simplified system for diagnostic bacteriology in Navy shipboard and sealed environment applications.
b. Develop simplified methods for rapid identification of microbial agents.

4. Treatment

(Programs in process of completion)

a. Complete clinical trials of therapeutic drugs for relapsing fever, schistosomiasis and tuberculous meningitis.

(Programs in FY 1978)

b. Evaluate and improve Navy Dental Plaque Control Program.

(Programs in FY 1978)

c. Continue clinical evaluation of chemotherapeutic agents against infectious tropical diseases.

(Programs in FY 1979)

d. Initiate clinical evaluation of National Institute of Health chemoprophylactic measures against dental caries.

NDCP - M0096-PN

22 February 1977

NAVY DECISION COORDINATING PAPER

FLEET HEALTH STANDARDS

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

IN REPLY REFER TO
Ser 987/139737
22 FEB 1977

From: Chief of Naval Operations
To: Chief, Bureau of Medicine and Surgery

Subj: Navy Decision Coordinating Paper, Fleet Health Standards (NDCP-M0096-PN)

Ref: (a) OPNAVINST 5000.42A of 3 March 1976; Subj: Weapon Systems Selection and Planning

Encl: (1) NDCP for Fleet Health Standards (NDCP-M0096-PN)

1. The Navy Decision Coordinating Paper (NDCP) for Fleet Health Standards is hereby promulgated and is forwarded as enclosure (1).

2. This NDCP has been prepared based upon inputs provided by the iterative process between the Bureau of Medicine and Surgery Fleet Health Standards program representatives working with OPNAV program representatives. The document provides the program approval authorization for the Fleet Health Standards Program as stated in reference (a).

B. B. ARMSTRONG
Director
Research, Development, Test and Evaluation

Copy to: (w/encl)
(see next page)

Ser 987/139737
22 February 1977

Copy to:

21A	(FLEET COMMANDERS-IN-CHIEF)
22	(FLEET COMMANDERS)
24A	(FLEET AIR FORCE COMMANDERS)
24D	(SURFACE FORCE COMMANDERS)
24E	(COMMINWARCOM) (CODE 005)
24F	(COMNAVLOGPAC)
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28G1	(COMSURFWARDEVGRU)
A1	(ASN(R&D)) only
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A6	(CMC)
C4F9	(NAVSURFWPNCENLAB, DAHLGREN) only
E3A	(NRL) (CODES 5409,4105, 7930) only
FKA1A	(COMNAVAIRSYSCOM)
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FKA1F	(COMNAVSUPSYSCOM)
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FKA61A	(NAVAIRDEVCEN)
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FKA6A2	(NAVWPNCEN)
FKA6A3A	(DTNSRDC) (CODE 5220)
FKA6A3B	(NAVCOASTSYSLAB)
FKA6A9	(NAVSURFWPNCEN) (WE-02)
FKA6A10	(NELC)
FKA6A11	(NAVUSEACEN)
FKA6A15	(NUSC NPT)
FT1	(CNET)

Others:
JCS
ASA(R&D)
ASAF(R&D)
DDR&E
NSA (Code S44) (3 copies)
DEFENSE MAPPING AGENCY
OPA
OPNAV:

00	943	957		01	23	37	06
09	944	96	986	10	29	39	60
090	945	098	099	12	03	401(6)	61
090N	095	980	991	02	32	50	63
094	951	981	992	21	34	51	64
941	953	982	099	22	35	55	
942	955	983					

Program Element 63706
ACAT III
OPNAV Action Officer
CAPT R.G. IRELAND (MC) USN
OP-098E
Project Manager
CDR P.D. NELSON (MSC) USN

NAVY DECISION COORDINATING PAPER
FLEET HEALTH STANDARDS

I. BACKGROUND

Advanced Medical Development is a continuing technology-base program in Navy RDT&E. Program content generally evolves from the Research and Exploratory Development phases of Medical R&D. Prior guidance provided by General Operational Requirement (GOR) 43, Personnel, and now by Science and Technology Objective Personnel/Medical (STO-PN), initiates efforts in areas of interest which subsequently become inputs to the program structure. Thus, promising technological approaches with Sea-Service applicability are further refined and tested in response to projected military medical requirements of future and potential combat arenas.

This document consolidates project efforts formerly included under Advanced Development Objective (ADO) 43-05.

II. REQUIREMENTS AND PROGRAM OBJECTIVES

A major responsibility of the Medical Department is that of recommending standards of physical and mental fitness appropriate for entry, assignment, and retention in the naval service. It also assumes responsibility for the related requirement of medical standards for occupational health and safety in naval service environments consistent with the mandates of Federal law (eg, the Occupational Safety and Health Act, 1970) as promulgated in OPNAVINST 5100.8C of 8 Sept 1975. The broad purpose of such standards is to safeguard the health of naval service personnel and to reduce the risks to such individuals, as well as costs to the service itself,

of occupational hazards and unusual stresses of duty, repeated admissions to the sick list, prolonged hospitalization, incapacity to perform one's duties, and premature invaliding from service.

The essential objective of this Advanced Development Project is to develop and validate the guidelines or procedures which result in standards of personal fitness or occupational health. That validation must be achieved against criteria of health and performance, especially in fleet environments and populations. Additionally, the feasibility of employing alternative standards must be evaluated in terms of manpower constraints, service career structures, medical support capabilities, operational procedures in training and the fleet, and the design of new systems.

The requirement for health and performance validated standards of personal fitness for duty is especially critical during periods of limited manpower availability. Rejections for physical conditions at service entry level among personnel who are aptitudinally qualified and required for skilled occupations are costly. Disqualification for psychiatric reasons is another major source of cost, particularly among those who are inducted, since psychiatric maladjustment is a leading cause of premature discharge from service each year. It is also a major source of cost in hospitalization and outpatient treatment. Even among those who are physically and mentally fit for general service duty, not all are equally fit for the specific demands of particular naval occupations or duty assignments. Hence, standards of fitness must often be developed for specific jobs as well as for general service. As women become an increasing proportion of the active duty force, valid standards for their screening, assignment, and retention must also be developed. At present the rates of hospitalization are disproportionately high among active duty women.

Short of illness and injury resulting in hospitalization, there are a variety of physical and mental stress demands imposed upon service personnel in the course of training and operational duties. Many of these result in impaired performance and can, if endured on a continuous basis, result eventually in personal injury or other health change. In some instances, the chronic exposure to occupational hazards of naval environments requires periods of years before resulting in overt illness which can become a permanent physical disability, and consequently a cost to the individual and the service alike. In other instances, of course, the stress effects on performance and health are realized sooner and are reversible. In either instance, special medical screening and diagnostic guidelines are needed for early recognition of debilitating stress and fatigue effects. Exposure limits and recovery guidelines must also be developed and tested for feasibility of use under training and operational conditions. In some instances these guidelines will be most useful for determining safe work procedures, while in others they will be of use in application to systems design.

In summary, the development and validation objectives can be defined in the broadest sense as follows:

- Medical screening guidelines for service entry, assignment, and retention standards;
- Medical guidelines for physical conditioning, work procedures, and stress/fatigue recovery standards;
- Medical guidelines for occupational health and safety standards.

III. PROGRAM ALTERNATIVES

One alternative of course is to simply continue current practices and abide by current standards. The present high costs of manpower losses from

service and the medical costs of treatment and disability render this alternative less than optimal. In many instances standards for personal fitness and occupational health do not yet exist; in other instances, standards exist but require further validation against performance and health measures. The latter stipulation deserves emphasis since recent Federal legislation and court rulings impose requirements for empirical validation of employment and occupational safety standards.

Another alternative is to adapt civilian standards to naval service personnel and environments. This option is inadequate for several reasons. First, as pertains to physical and mental standards of fitness there are no general civilian standards applicable to the military services. In those instances for which civilian standards exist for specific occupations, common to civil and military sectors, such as in aviation, population differences and the duty demands on military service personnel are sufficiently unique in most instances as to render civilian standards less than optimal for military use. For occupational health and safety standards, the civilian standards which do exist typically pertain to a more limited range of hazards than can be experienced in the military and, equally important, civilian exposure standards (eg, 5 day, 40 hour work week) are not necessarily applicable to naval service duties, particularly those performed in continuous operations at sea under conditions of fleet deployment.

A third alternative is to rely upon other military services for such standards. Though the services closely coordinate their medical policies and research on these issues, with few exceptions the other services are no more advanced in their development of such standards than the Navy. Furthermore, differences between service populations, duty environments, and operational procedures are sufficient to necessitate service-specific

standards in many instances.

IV. RISKS

Relative to the potential cost benefit in manpower savings, reduced duty days lost, and reduction in expenditures for medical treatment and disability compensation, the development investment risks of this project are generally low. Previous experience in the development of useful screening standards is a case in point. An investment of less than $1 million over a decade of R&D (only a portion of which was advanced development) has resulted in psychiatric screening guidelines for first-enlistment accessions with an estimated savings of about 3,000 premature discharges a year if properly applied. At a recent DoD cost estimate of about $3000 per recruit training graduate, an annual savings of about $9 million would be realized from recruit training alone as a result of that development. In the initial screening and secondary selection of naval aviators, an estimated $12 million savings a year is now realized as a result of a ten-year R&D investment of less than $3 million (again with only a portion of that in advanced development). Furthermore, aviator attrition from the expensive advanced stages of training has been reduced by about 50%.

On a more technical level, the validation of personal fitness and occupational health standards requires time. Longitudinal evaluations are typically required. In some instances, for which segments of naval service careers must be evaluated, the investment risk can become at least moderate since cost over time required in longitudinal health and performance evaluations accumulates. Nevertheless, in comparison with the potential cost savings, investment risks for this type of development remain relatively minimal. Somewhat greater risk is perhaps entailed at the basic research and exploratory development levels of effort. At those levels the effects

on health and performance of many individual and environmental characteristics as well as their interactions must be initially defined so that the more critical parameters and methodologies for measuring effects can be submitted to validation and feasibility testing under advanced development.

V. OTHER FACTORS

The project presents no adverse environmental impact. Instead, project advancements provide positive impacts on the natural environment in every instance wherein health maintenance for man is improved. Project thrusts are unique from those in other DoD Medical R&D Programs. Technology advancements are made available for utilization within the world of medical knowledge and are applicable to all combat and operational scenarios.

VI. RESOURCE AND DEVELOPMENT PLANS

The estimated costs for achievement of the program objectives are shown in the Program Resource Plan, Table I.

Major program thrusts leading to development of new and/or improved fleet health standards are depicted in Table II, the Program Development Plan.

Because of the relatively limited resources available for this project and the potentially great number of standards in need of development and validation for personal fitness and occupational health, major thrusts at this time are selected on the basis of priorities resulting from known costs of particular problems, operational need, and state of technology which would indicate likelihood of near-term payoff from advanced development.

VII. DESIGN TO COST

Not applicable

VIII. TEST AND EVALUATION

Not applicable in "hardware sense." Acceptable testing methodologies are employed for scientific validation.

IX. MANAGEMENT

The program is managed by the Naval Medical Research and Development Command (NMRDC) with close liaison and advice from the Bureau of Medicine and Surgery, Bureau of Naval Personnel, Chief of Naval Material, Headquarters, Marine Corps, and other Navy organizations. Individuals responsible for program management and scientific monitoring are:

Director, RDT&E, N	Program Sponsor
DCNO Logistics (OP-04)	Mission and Resource Sponsor
CAPT R. IRELAND (MC) USN	OPNAV Development Coordinator
CDR P.D. NELSON (MSC) USN	Human Performance Program (NMRDC)
LCDR L. DOPTIS (MSC) USN	Fleet Occupational Health Program (NMRDC)

Technical work conducted by contract will be under the contractual management of Office of Naval Research (ONR) Codes 441 and 443.

Decisions concerning program direction and funding are made by the program managers based on the recommendations of consultants having technical or operational expertise in various aspects of the program. Periodic review of requirements and priorities as well as program coordination between the military services and other government agencies are accomplished through technical working groups, technical coordinating papers, and joint (interservice) medical research conferences.

In-house laboratories and contractors report by means of annual status reports, technical reports or scientific publications at the conclusion of major phases of work, formal presentations at scientific meetings, and by informal discussion at site visits. Program management prepares formal reporting documentation as necessary and presents briefings as requested.

X. SECURITY

The requirement for and all of the technologies developed in response to this requirement are unclassified and are releasable on a need to know basis.

XI. REVISION

This NDCP will be reviewed annually and updated as deemed appropriate.

TABLE I

PROGRAM RESOURCE PLAN
($ in M)

Program Element: 63706N Title: Advanced Medical Development

Projects:	FY 76	FY TQ	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82
Fleet Health Technology M0095-PN	3.5	1.0	4.6	4.9	5.1	5.3*	5.4*	5.5*
Fleet Health Standards M0096-PN	0.7	0.2	0.7	0.7	0.7	0.7	0.7	0.7
Input Injury Prevention M0097-PN	1.4	0.3	1.2	1.3	0.9	0.7	0.4	-
	5.6	1.5	6.5	6.9	6.7	6.7*	6.5*	6.2*

*Includes $0.9M, $1.1M and $1.2M for continuations of efforts relating to Medical Support Systems (formerly M0096).

PROGRAM DEVELOPMENT PLAN

Program Plan Thrusts for the Development and/or Improvement of Fleet Health Standards

A. Personal Fitness Standards (Physical and Mental)

- Psychiatric Screening Guidelines for High Risk Occupations and Duty Environments
- Psychiatric Diagnosis, Treatment, and Return-to-Duty Guidelines for Fleet Personnel
- Physical Fitness Guidelines for Recruit Training and Shipboard Duty
- Performance Readiness Guidelines for Fleet Aviators
- Auditory and Visual Screening Standards for Critical Occupations and Fleet Assignments

MILESTONES	DATES
Complete psychiatric screening guidelines for high risk occupations.	FY79
Complete psychiatric screening guidelines for female enlistees.	FY80
Complete model for management of fleet psychiatric problems.	FY80
Complete auditory and visual screening guidelines for submarine & shipboard personnel.	FY80
Complete fleet aircrew performance quality control guidelines.	FY81
Complete physical conditioning guidelines for fleet personnel.	FY82
Complete dynamic visual screening test for aviators.	FY83

FUNDING ($ in Millions and tenths)

FY	79	80	81	82	83
	0.4	0.5	0.4	0.4	0.4

B. Occupational Health Standards (Environment)

- Human Vibration and Low frequency Linear Motion Tolerance Limits for Fleet Environments
- Noise Exposure, Recovery, and Protective Standards for Fleet Environments*
- Heat Exposure, Recovery, and Protective Standards for Fleet Environments*
- Chemical Toxicant Exposure, Recovery, and Protective Standards for Fleet Environments*

MILESTONES	DATES
Complete human vibration effects model.	FY79
Complete human vibration and low-frequency linear effects prediction model.	FY81

FUNDING ($ in Millions and tenths)

FY	79	80	81	82	83
	0.3	0.2	0.3	0.3	0.3

*Presently without advanced development resources

NDCP - M0097-PN

NAVY DECISION COORDINATING PAPER

IMPACT INJURY PREVENTION

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

IN REPLY REFER TO

Ser 987/139745
24 FEB 1977

From: Chief of Naval Operations
To: Chief, Bureau of Medicine and Surgery

Subj: Navy Decision Coordinating Paper, Impact Injury Prevention (NDCP-M0097-PN)

Ref: (a) OPNAVINST 5000.42A of 3 March 1976, Subj: Weapon Systems Selection and Planning

Encl: (1) NDCP for Impact Injury Prevention (NDCP-M0097-PN)

1. The Navy Decision Coordinating Paper (NDCP) for Impact Injury Prevention is hereby promulgated and is forwarded as enclosure (1).

2. This NDCP has been prepared based upon inputs provided by the iterative process between Bureau of Medicine and Surgery Impact Injury Prevention program representatives working with OPNAV program representatives. The document provides the program approval authorization for the Impact Injury Prevention Program, as stated in reference (a).

P. B. ARMSTRONG
Director
Research, Development, Test and Evaluation

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(See next page)

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22	(FLEET COMMANDERS)
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24G	(SUBMARINE FORCE COMMANDERS)
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FKA1C	(COMNAVFACENGCOM)
FKA1F	(COMNAVSUPSYSCOM)
FKA1G	(COMNAVSEASYSCOM) (SEA 0313)
FKA51A	(NAVAIRDEVCEN)
FKA6A16	(NAVPERSRANDCEN)
FKA6A2	(NAVWPNCEN)
FKA6A3A	(DTNSRDC) (Code 5220)
FKA6A3B	(NAVCOASTSYSLAB)
FKA6A9	(NAVSURFWPNCEN) (WE-02)
FKA6A10	(NELC)
FKA6A11	(NAVUSEACEN)
FKA6A15	(NUSC NPT)
FT1	(CNET)
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Others:

JCS
ASA(R&D)
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NSA (CODE S44) (3 copies)
DEFENSE MAPPING AGENCY
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OPNAV:

00	943	957		01	23	37	06
09	944	96	986	10	29	39	60
090	945	098	099	12	03	401 (6)	61
090N	095	980	991	02	32	50	63
094	951	981	992	21	34	51	64
941	953	982	009	22	35	55	
942	955	983					

Program Element 63706
ACAT III
OPNAV Action Officer
CAPT R.G. IRELAND (MC) USN
OP-098E
Project Manager
CAPT R.K. OHSLUND (MC) USN

NAVY DECISION COORDINATING PAPER

IMPACT INJURY PREVENTION

I. BACKGROUND

Air Crew Impact Injury Prevention is an ongoing technology-base Project in the Navy Advanced Medical Development RDT&E Program. Prior guidance for this project was provided by General Operational Requirement (GOR) 43-Personnel, Advanced Development Objective (ADO) 43-05X, Advanced Medical Development, and ADO 45-59X, Helo Escape and Survival. Formerly ADO 43-12X, Aircrew Impact Injury Prevention, this project was established in August 1970 to prepare a predictive system to forecast the relative effectiveness of existing and/or newly proposed systems for protection against impact injury due to crashes, ejections, parachute opening shock, and windblast.

II. REQUIREMENTS AND PROGRAM OBJECTIVES

The loss of highly skilled and extensively trained aircrew personnel who are either killed or permanently disabled as a result of injuries received from impact forces generated by ejection and/or by otherwise survivable aircraft crashes of fixed and rotary wing aircraft has a direct and significant effect on Department of Defense operational capability. The high death and disabling injury rates from military helicopter and ground vehicle crashes, as well as from "collision with water" accidents peculiar to low speed, low altitude flight profiles, necessitate the development of impact protection devices to lower the fatality rate in those accidents which do occur. Examples of these devices are now available; but there is no valid anthropomorphic manikin by which to test and evaluate

them in a standard manner. In order to test manikins to be developed for use in such tests, dynamic human responses must be measured to determine critical parameters responsible for injury.

The objectives of the Impact Injury Prevention Project therefore, are to determine human dynamic responses to impact accelerations, and the correlation with physiological effects and injuries. This information will then be used in the further evolution of analytical models. These models will allow the design and evaluation of human impact protection devices and escape systems, and the production of specifications for the design, development, and validation of human analogs. A family of anthropomorphic manikins will then be developed for realistic, simulated testing of ejection seats and life-support sub-systems. Achievement of these vitally important milestones rests on the continued development of the human data base described herein. Existing and anticipated legal restrictions, as well as ethical considerations concerning the use of human volunteer subjects generate the mandate to obtain the requisite and essential data base prior to premature legal requirements for total simulation.

III. PROGRAM ALTERNATIVES

The Army, Navy, and Air Force, as well as National Aeronautic and Space Administration (NASA), Department of Transportation (DOT), and several civilian concerns have a wide variety of ongoing biomedical RDT&E efforts related to impact injury. The scientific staff and facility involved in the Navy Aircrew Impact Injury Prevention Project are unique in their capability to produce accurate and precise human impact response data and reliable protective system evaluation. The legal doctrine of "contingent liability" would appear to make the use of live human volunteer subjects in impact/acceleration experiments impractical unless an organization

wealthy enough to do so assumes the contingent liability. The U.S. Government assumed this liability when the Congress passed a oill authorizing the use of human volunteers from the Armed Forces as subjects in experiments in acceleration/deceleration and authorizing payment of hazardous duty pay to such volunteers. Direct costs, indirect Governmental liability, and lack of subject continuity all preclude use of contract (non-military) subjects. Useful options, therefore, are limited to financial mechanisms.

IV. RISKS

The risks involved with the use of human volunteer subjects have been thoroughly investigated and every precaution has been and will be taken to insure that no injury will occur during these tests. Volunteer applicants receive extensive physical and emotional screening before selection, and a Human Use Safety Committee has approved the equipment and experimental design. An on-site emergency treatment facility is staffed and ready during each manned experimental "run". Each such "run" involves a suitably instrumented volunteer subject riding a vehicle along a track. The volunteer is subjected to varying dynamic forces produced by the acceleration of the vehicle. For safety, the experimental design stipulates small stepwise increments in forces. To date there have been no injuries in over 1600 such impact acceleration exposures on volunteers. The risks involved in not completing this program are of greater magnitude, for not only is this information vital for the design and evaluation of various air, sea, and ground vehicle restraint protection devices and escape systems, but without this information no correlation between theoretical and actual human response to impact accelerations is possible. The engineering design and development of all man related restraint, protection, escape, and survival devices would then continue without the input of valid data

on human respone.

V. OTHER FACTORS

The project presents no adverse environmental impact. Rather, project advancements provide positive input to the area of human crash survivability. Technology advancements are made immediately available for utilization within the civilian and military engineering communities and are applicable to all military combat and operational training scenarios. Project planning and priorities are well coordinated within the services. Information exchange is facilitated through project reports, meetings, and reviews. The Department of Transportation is currently utilizing some of the preliminary data as it works toward civilian transportation safety, and major automobile manufacturers are incorporating some of this same data into designs for new vehicles.

VI. RESOURCE AND DEVELOPMENT PLANS

The estimated costs for achievements of the program objectives are shown in the resource plan, Table I. Major thrusts leading to development of new and/or improved technologies or guidelines for impact injury prevention are outlined in Table II, the Project Development Plan.

VII. DESIGN TO COST

Not applicable

VIII. TEST AND EVALUATION

Early data from this program have recently been used in the validation of existing mathematical models designed to predict human response to impact. Use of the same data has shown that present-generation anthropomorphic manikins do not provide realistically valid responses to ejection, flail, or impact forces.

IX. MANAGEMENT

The program is managed by the Naval Medical Research and Development

Command (NMRDC) with close liaison and advice from the Bureau of Medicine and Surgery, Bureau of Naval Personnel, Chief of Naval Material, Headquarters, Marine Corps, and other Navy organizations. Individuals responsible for program management and scientific monitoring are:

Director, RDT&E, N	Program Sponsor
DCNO Logistics (OP-04)	Mission and Resource Sponsor
CAPT R. IRELAND (MC) USN	OPNAV Development Coordinator
CAPT R. OHSLUND (MC) USN	Aircrew Systems Biomed Support Program (NMRDC); Program Manager

Technical work conducted by contract will be under the contractual management of Office of Naval Research (ONR) Codes 441 and 443.

Decisions concerning program direction and funding are made by the project manager based on the recommendations of consultants having technical or operational expertise in various aspects of the program. Periodic review of requirements and priorities as well as program coordination between the military services and other government agencies are accomplished through technical working groups, technical coordinating papers, and joint (ie, interservice) medical research conferences.

In-house laboratories and contractors report by means of annual status reports, technical reports or scientific publications at the conclusion of major phases of work, formal presentations at scientific meetings, and by informal discussion at site visits. Program management prepares formal reporting documentation as necessary and presents briefings as requested.

X. SECURITY

The requirement for and all of the technologies developed in response to this requirement are unclassified and are releasable on a need to know basis.

XI. REVISION

This NDCP will be reviewed annually and updated as deemed appropriate.

TABLE I

PROGRAM RESOURCE PLAN
($ in M)

Program Element: 63706N — Title: Advanced Medical Development

Projects:	FY 76	FY TQ	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82
Fleet Health Technology M0095-PN	3.5	1.0	4.6	4.9	5.1	5.3*	5.4*	5.5*
Fleet Health Standards M0096-PN	0.7	0.2	0.7	0.7	0.7	0.7	0.7	0.7
Input Injury Prevention M0097-PN	1.4	0.3	1.2	1.3	0.9	0.7	0.4	-
	5.6	1.5	6.5	6.9	6.7	6.7*	6.5*	6.2*

*Includes $0.9M, $1.1M and $1.2M for continuations of efforts relating to Medical Support Systems (formerly M0096).

TABLE II

PROJECT DEVELOPMENT PLAN

A. Impact Acceleration: Injury Prevention

--- Continuation of instrumented human exposure/experiments

--- Development of computerized analytical mathematical human response models

--- Extension of mathematical model to develop and validate performance for criteria for anthropomorphic manikins

--- Use of manikin at limits of projected impact/acceleration envelopes to preclude extreme human risk

Milestones (U)

Items	Dates
3500 accelerator runs; develop design criteria for impact protection systems	FY79
4500 accelerator runs; complete hardware, software, and airframe testing	FY80
5000 accelerator runs; complete reports and final model	FY81
Construct manikin and begin testing	FY82
Complete testing and validation of manikin	out years
Use of manikin as human surrogate	out years

Appendix H

Research Resumes (1498's)

Index of
Research and Technology Work Unit Summaries
(DD-Form 1498's -- Resumes)

IN-HOUSE

CONTRACT

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	771001	DD-DR&E (AR) 636-3900

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. NEW	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Auditory hazards of earphone transduced signals and interior aircraft noise to Navy aviation personnel.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 007900 Occupational medicine 005900 Environmental biology 012400 Personnel selection and maintenance 021000 Radio communications

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7710	7909	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 78	1.0	69

19. RESPONSIBLE DOD ORGANIZATION 391586
NAME:* Naval Medical Research and Development Command
ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME:
TELEPHONE:

20. PERFORMING ORGANIZATION 406061
NAME:* Acoustical Sciences Division Medical Sciences Department
ADDRESS:* Naval Aerospace Medical Res. Lab. Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* ROBERTSON, R. M., GS-13
TELEPHONE: 904-452-4457

ASSOCIATE INVESTIGATORS
NAME: WILLIAMS, C.E.
NAME: MAXWELL, D.W.

21. GENERAL USE
C

22. KEYWORDS *(Precede EACH with Security Classification Code)* CIVAPP: (U) General aviation (U) Speech communications (U) Human subjects (U) Aviation (U) Hearing (U) Noise (U) Hearing conservation

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. Technical Objective (U) To define the auditory hazards of earphone transduced signals and interior aircraft noise to Navy aviation personnel. Such knowledge is essential for (1) incorporating the effects of earphone transduced signals into damage risk standards, (2) assessing the adequacy of current aircrew protective and communications equipment, and (3) insuring optimum speech discrimination in critical voice communication situations.

24. Approach (U) Noise exposure profiles, hearing threshold levels, preferred listening levels and speech discrimination performance scores will be obtained from naval aviation instructor pilots and aircrew personnel regularly exposed to interior aircraft noise and earphone transduced signals in naval aircraft. Data will be obtained in flight and in the laboratory. Inflight measurements will be made of the ambient noise at various crew positions within each aircraft. Noise and transduced signal levels at the ear (under helmet) of each subject will also be made. Speech intelligilility test materials (Tri-word Modified Rhyme Test) will be transmitted to the subjects both in actual in-flight test situations and in simulated test environments. Cumulative noise exposures determined by personnel noise dosimetry will be compared with noise exposures calculated on the basis of sound level measurements and time duration. Identification will be made of those aircraft crew positions where interior noise levels and earphone transduced signals pose a risk to the auditory health and safety of naval aviation personnel.

25. Progress. New work unit.

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	761001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Development of operational auditory performance standards for Navy aviation personnel.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

000200 Acoustics 021400 Personnel selection and maintenance (medical)

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	8009	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: NA EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 77	1.1	63.4

19. RESPONSIBLE DOD ORGANIZATION 406061

NAME:* Naval Aerospace Medical Research Laboratory

ADDRESS:* Pensacola, Florida 32508

RESPONSIBLE INDIVIDUAL

NAME: MITCHEL, R.E. CAPT MC USN

TELEPHONE: AREA Code– 904-452-3286 Autovon:922-3286

20. PERFORMING ORGANIZATION 406061

NAME:* Acoustical Sciences Division Naval Aerospace Medical Research Laboratory

ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* MOSKO, J.D. Ph.D. GS13

TELEPHONE: 904-452-4457 Autovon 922-4457

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Psychoacoustics (U) Auditory performance (U) Medical standards

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23(U) The objective of this proposal is to develop a workable set of psychoacoustic standards which reflect the operational requirements for the human auditory system over a broad spectrum of Naval aviation tasks.

24(U) The program of research to be conducted will be based on the role of the auditory system in relation to the overall task performance. The requuirements for the auditory system will be derived from a single operational model of task performance. Inputs to the model will come from: 1) compilation and analyses of operational tasks; 2) description and analyses of operationally relevant auditory sensory inputs and relevant auditory processing requirements; 3) description and analyses of environmental and psychophysiological factors which influence auditory performance; and 4) laboratory and field experiments with operational personnel to confirm the applicability of the psychoacoustic standards.

25(U) NA

**Available to contractors upon originator's approval*

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DD-DDR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
771001	D. CHANGE	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	63706N	M0096PN	M0096PN001	1030
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)** (U) Development of operational auditory performance standards for Navy aviation personnel

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

000200 Acoustics 012400 Personnel selection and maintenance (medical)

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	8009	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 78	1.0	56
	CURRENT 79	1.0	69

19. RESPONSIBLE DOD ORGANIZATION 391584
NAME:* Naval Medical Research and Development Command
ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME: J. D. BLOOM, CAPT, MC, USN
TELEPHONE: AREA Code—202— 295-1453

20. PERFORMING ORGANIZATION 406061
NAME:* Medical Sciences Department Naval Aerospace Medical Res. Lab.
ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* MOSKO, J. D., Ph.D.
TELEPHONE: 904-452-4457

ASSOCIATE INVESTIGATORS
NAME: WILLIAMS, C. E., Ph.D.
NAME:

21. GENERAL USE M

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Auditory performance (U) Medical standards (U) Psychoacoustics (U) Human subjects

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. TECHNICAL OBJECTIVE (U) The objective of this proposal is to develop a workable set of psychoacoustic standards which reflect the operational requirements for the human auditory system over a broad spectrum of naval aviation tasks.

24. APPROACH (U) The research will define the role of the human auditory system in relation to task performance. Auditory requirements will be derived from an operational model of task performance. Inputs to the model will come from: (1) analyses of operational tasks; (2) analyses of operationally relevant auditory sensory inputs and auditory processing requirements; (3) analyses of environmental and psychophysiological factors which influence auditory performance; and (4) laboratory and field experiments to confirm the applicability of the psychoacoustic standards.

25. PROGRESS (U) (771001-780331) A field study conducted aboard CV-59, USS Forrestral analyzed a variety of jobs during day and night flight operations to catalog the sensory inputs of certain operational environments. Examples were radar and sonar operators, flight operations officer, catapult officer and deck-deck edge personnel. Auditory inputs were received the highest percentage of the time by flight operations officer (80-90%) and lowest by deck personnel (10-15%) but in all jobs the auditory input was the primary sensory input for task completion. A laboratory study investigated the combined effects of noise and hearing protection on speech intelligibility. The condition of four noise levels (from 40-100db), two S/N ratios (0 and 4db) and 4 listening conditions with and without ear plugs, were found to show a consistent detrimental effect on speech intelligibility when hearing protection was worn.

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
977561	781001	DD-DDR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. NEW	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	ZF51524	ZF51524023	1014
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)**
(U) Development of specifications for a microprocessor controlled audiometer, data bank and data base management system for use in Navy hearing conservation programs

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
005100 Documentation and information technology 007900 Occupational medicine 016400 Subsystems 004200 Computers 005900 Environmental biology

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7810	8009	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 78	0.0	0.0
FISCAL YEAR CURRENT 79	2.2	108

19. RESPONSIBLE DOD ORGANIZATION 391584
NAME:* Naval Medical Research and Development Command
ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME: J.D. BLOOM, CAPT, MC, USN
TELEPHONE: AREA Code—202— 295-1453

21. GENERAL USE C

20. PERFORMING ORGANIZATION 406061
NAME:* Medical Sciences Department Naval Aerospace Medical
ADDRESS:* Research Laboratory Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* ROBERTSON, R. M., Ph.D.
TELEPHONE: 904-452-4457

ASSOCIATE INVESTIGATORS
NAME: GREENE, J.W.
NAME: WILLIAMS, C.E., Ph.D.

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Hearing (U) Hearing conservation (U) CIVAPP: Industrial hearing conservation

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. TECHNICAL OBJECTIVE (U) (1) To develop specifications for a microprocessor based audiometer for use in Navy hearing conservation programs; and (2) to develop a hearing conservation data bank and data base management system that will be responsive to both O&M and R&D needs. These objectives coincide with Navy goals for the identification of personnel who exhibit hearing losses, the identification of environments which pose hazards to hearing, and the determination of the effectiveness of the overall hearing conservation programs.

24. APPROACH (U) Conduct user field evaluations of microprocessor controlled audiometers from two manufacturers (selected on the basis of evaluations conducted during FY-78) in individual and group test configurations. Define equipment requirements for various types of naval installations and ships. Write audiometer performance specifications for assembly of a prototype. Define input information requirements for the data bank through a workshop and direct field contacts. Determine the most efficient way to get information from the local test site to the data bank and define the optimal data retrieval system. Conduct an inventory of federal automated data processing facilities to identify possible data base sites. Conduct laboratory and field test and evaluation of prototype audiometer. Analyze the applicability of extant hearing conservation data base management systems for possible Navy use. Establish a model data bank at NAMRL using an Interdata 7/32. Develop a plan for the system to be made operational.

25. PROGRESS. (U) N/A

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DN 877428	780930	DD-DDR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DOWNGRADING CONTRACTOR ACCESS	9. LEVEL OF SUMMARY
771001	K. Completion	U	U	X	NL	X YES ☐ NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	F51524	ZF51524023	2008
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)** (U) Exploratory assessment of automated hearing test systems for use in Navy hearing conservation programs

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 007900 Occupational medicine 005900 Environmental biology 003500 Clinical medicine

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7801	7809	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 77	0.0	000.
	CURRENT 78	1.5	86

19. RESPONSIBLE DOD ORGANIZATION 391584

NAME:*
ADDRESS:* Naval Medical Research and Development Command
National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME: J. D. BLOOM, CAPT, MC, USN
TELEPHONE: AREA Code–202– 295-1453

20. PERFORMING ORGANIZATION 406061

NAME:* Medical Sciences Department
Naval Aerospace Medical
ADDRESS:* Research Laboratory
Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* WILLIAMS, C.E., Ph.D.
TELEPHONE: 904-452-4457

ASSOCIATE INVESTIGATORS
NAME: ROBERTSON, R. M., Ph.D.
NAME: GREENE, J. W.

21. GENERAL USE

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Hearing (U) Hearing conservation (U) Hearing standards (U) CIVAPP Industrial hearing conservation (U) Human subjects

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. TECHNICAL OBJECTIVE (U) To assess selected prototype and/or production model automated hearing test systems for potential use in Navy hearing conservation programs and to develop basic performance requirements for the development of such a system for Navy use.

24. APPROACH (U) Conduct exploratory laboratory and field assessments of selected prototype and/or production model automated hearing test systems. In addition to determining the relative merits of the systems, obtain hearing threshold levels (HTLs) on normal hearing individuals and individuals with sensorineural hearing losses. Obtain HTLs on the same subjects utilizing conventional manual audiometry. Compare thresholds and the time required to obtain thresholds. On the basis of the exploratory assessments, develop a set of performance requirements for the development of an automated hearing test system for Navy use.

25. PROGRESS (U) (780101-780401) Technical specifications have been assembled on 8 microprocessor controlled audiometers. Four units have been demonstrated by manufacturer representatives. Data collection is well underway on two of the five units to be evaluated (Audiometer Corporation of America and Environmental Technology Corporation). HTL data have been obtained on 85 subjects (53 normal hearing and 32 sensorineurals). Data obtained thus far indicate no clinically significant difference ($>\pm$ 5 dB) between HTLs obtained on the microprocessor units and HTLs obtained via manual audiometry. There is a trend for the automated units to require less testing time. An overall report describing the results of this study will be submitted upon completion.

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION *	2. DATE OF SUMMARY *	REPORT CONTROL SYMBOL
	761001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY *	6. WORK SECURITY *	7. REGRADING *	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. NEW	U	U	NA	NI	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES. *	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

(U) Hand-held, digital, sound-level meter

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

000200 Acoustics 007900 Industrial (occupational) medicine

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	7809	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER: * NA

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 77	.6	54.0

19. RESPONSIBLE DOD ORGANIZATION 406061

NAME: * Naval Aerospace Medical Research Laboratory

ADDRESS: * Pensacola, Florida 32508

RESPONSIBLE INDIVIDUAL

NAME: MITCHEL, R.E. CAPT MC USN

TELEPHONE: 904-452-3286 Autovon 922-3286

20. PERFORMING ORGANIZATION 406061

NAME: * Acoustical Sciences Division
Electronic Services Division

ADDRESS: Naval Aerospace Medical Res. Lab.
Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME: *

TELEPHONE: MOSKO, J.D. Ph.D GS 13
904-452-4457 Autovon: 922-4457

ASSOCIATE INVESTIGATORS

NAME: MOLINA, E.A. MSEE GS13

NAME:

21. GENERAL USE

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Acoustic measurement (U) Sound level meter (U) Noise meausrement

23. TECHNICAL OBJECTIVE. * 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) To design, build, and evaluate a hand-held, digital, sound-level meter which will provide various predetermined metrics for noise characterization.

24. (U) Current state-of-the-art techniques in linear and digital electronic circuitry will be used. A microprocessor CPU in conjunction with a read only memory, and integrated analog circuitry will permit the construction of the necessary components to provide the accuracy needed. Keyboard retrieval of stored functions and display of these functions using light emitting diodes will provide relatively immediate access of descriptive metrics to the operator. An operation manual will be written to accompany the sound level meter.

25. (U) NA

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	771001	DD-DR&E (AR) 636(3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. New	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Investigation of brainstem auditory evoked responses as a new measure of sensorineural performance of naval aviation personnel..

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 012400 Personnel Selection and Maintenance 002400 Bioengineering 012500 Personnel Selection and Training 012900 Physiology 013400 Psychology

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7710	8009	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 77	0	0
FISCAL YEAR CURRENT 78	0.8	52

19. RESPONSIBLE DOD ORGANIZATION 391586
NAME:* Naval Medical Research and Development Command
ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME:
TELEPHONE:

21. GENERAL USE
C

20. PERFORMING ORGANIZATION 406061
NAME:* Acoustical Sciences Division Medical Sciences Department
ADDRESS:* Naval Aerospace Medical Res. Lab. Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* MOSKO, J.D., Ph.D.
TELEPHONE: 904-452-4457

ASSOCIATE INVESTIGATORS
NAME: HIXSON, W.C.
NAME: PAGE, J.C.

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Sensory Mechanisms (U) Neural Mechanisms (U) Aging (U) Naval Aviation (U) Crew Performance (U) Auditory Function CIVAPP; (U) Neurology

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23(U) Technical Objective: Recent research and clinical applications of brainstem auditory evoked response technology indicate that this measure may provide a sensitive means for the early detection of sensorineural changes that occur 1) as a function of aging, both natural and premature, and 2) as a result of exposure to environmental stressors. It will be the objective of this work unit to conduct exploratory research that will evaluate the potential contributions of brainstem technology to the medical management of naval aviation personnel.

24(U) Approach: Before brainstem technology can find application in the evaluation of naval aviation personnel, baseline data must be collected which define the normative range of responses for this broad age-spectrum population. Although all forms of electrophysiological measures require normative references to be effective, the need is specific for brainstem responses in that the latency of the predominant waveforms is strikingly age dependent. Since this feature in itself may serve to quantify sensorineural aging of naval personnel, first priority will be given to the acquisition of brainstem data from naval aviation personnel stationed at Pensacola ranging in age from 20 years to 50 years. This population will be subdivided into six equal increment age categories with a minimum of 30 individuals in each category. The collection of these baseline data is considered to be an essential cornerstone to follow-up research that will deal with modifications of the brainstem response by various environmental stressors.

25(U) Progress: New work unit proposal.

**Available to contractors upon originator's approval*

HE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	761001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

(U) The landing signal officer: auditory aspects

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 007900 Occupational medicine 013300 Protective equipment 020000 Human operator control characteristics 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	780331	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: NA EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 77	1.4	50.4

19. RESPONSIBLE DOD ORGANIZATION 406061

NAME:* Naval Aerospace Medical Research Laboratory

ADDRESS:* Pensacola, Florida 32508

RESPONSIBLE INDIVIDUAL

NAME: MITCHEL, R.E., CAPT MC USN

TELEPHONE: AREA Code-904-452-3286 Autovon:922-3286

20. PERFORMING ORGANIZATION 406061

NAME:* Acoustical Sciences Division
Naval Aerospace Medical Res. Lab.

ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* ROBERTSON, R.M., Ph.D. GS13

TELEPHONE: 904-452-4457 Autovon: 922-4457

ASSOCIATE INVESTIGATORS

NAME: PAGE, J.P. MS GS11

NAME: MAXWELL, D.W. BS GS9

21. GENERAL USE H

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Aviation (U) Noise (U) Hearing (U) Hearing protection (U) Auditory cues

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23(U) To quantitatively describe typical noise exposure profiles of Landing Signal Officers (LSOs) and to relate the obtained profiles to auditory hazard; to determine the extent to which auditory cues are employed by the LSO in judging the acceptability of certain pilot/aircraft approach performance parameters; and to determine the most effective means of protecting the hearing of the LSO.

24(U) Typical LSO noise exposures will be documented for qualified LSOs during both field carrier landing practice (FCLP) and carrier operations. Procedural techniques will involve personal noise dosimetry and the determination of time/intensity trading functions and their relation to current damage risk criteria. Questionnaires will be distributed to a significant number of LSOs Navy wide to elicit responses related to the extent to which they utilize auditory cues for boarding aircraft. Several "active" and "standard" types of hearing protective devices will be evaluated to determine which type is most applicable to the LSO's situation. Evaluations of the devices will be conducted during both FCLP and carrier operations. Laboratory evaluations of the devices will also be conducted. Evaluations will include real ear attenuation measures and verification of the electroacoustic properties of the "active" type devices. Fabrication and/or modification of devices will be carried out as necessary to meet the objectives.

*Available to contractors upon originator's approval

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HE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1.AGENCY ACCESSION*	2.DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DDR&E (AR) 636 (3900)

3.DATE PREV SUM'RY	4.KIND OF SUMMARY	5.SUMMARY SCTY*	6.WORK SECURITY*	7.REGRADING*	8a.DISB'N INSTR'N	8b.SPECIFIC DATA-CONTRACTOR ACCESS	9.LEVEL OF SUM
771001	D. CHANGE	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10.NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	F51524	ZF51524004	9017
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)**

(U) Aviation multitask information processing measurement.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) 007500 Human Factors Engineering 013402 Psychology (Individual and Group Behavior)

13.START DATE	14.ESTIMATED COMPLETION CATE	15.FUNDING AGENCY	16 PERFORMANCE METHOD
7505	8009	DN	C. In-House

17.CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18.RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 78	3.0	116
FISCAL YEAR CURRENT 79	4.5	197

19.RESPONSIBLE DOD ORGANIZATION 398514

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J.D. BLOOM, CAPT, MC, USN

TELEPHONE: AREA Code—202— 295-1453

20.PERFORMING ORGANIZATION 406061

NAME:* Aerospace Psychology Department
Naval Aerospace Medical
Research Laboratory

ADDRESS:* NAS, Penscola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* Waldeisen, L.E., CDR MSC USN (Ph.D)

TELEPHONE: 904-452-3281 (P.E.)

ASSOCIATE INVESTIGATORS

NAME: Harris, S.D., LT MSC USNR

NAME:

21. GENERAL USE

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Human Subjects (U) Complex Performance (U) Performance Measurement (U) Human Capabilities (U) Information Processing

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23.(U) Objective: The increasing number and complexity of tasks in modern, high performance aviation systems exact high levels of information processing demands and situational stresses on naval aviators. The degradation in human performance which can result under conditions of multiple, simultaneous task demands often compromises the optimal performance of the total aviation system. Future enhancements of total systems efficiency, effectiveness, and safety are dependent upon improved means to measure and specify the quality of human performance in complex systems. This project is directed toward the systematic development of a methodology for measuring and assessing concurrent, multitask performance capabilities and limitations of human operators in aviation-relevant task situations.

24.(U) Approach: An automated research test system, including state-of-the-art display and control technology, is used to configure tasking situations which simulate a number of the critical information processing requirements of actual aircrew tasks. Comprehensive assessments of human performance in combined auditory and visual tasks requiring voice or manual (discrete or continuous) control are made possible through the use of advanced Voice Recognition And Synthesis (VRAS) system capabilities and a flexible graphics processor with CRT information display. The measurement methodology incorporates the selective utilization of adaptive task loading techniques to adjust workload in single-task conditions to the skill level of each operator. Performance in combined-task conditions is evaluated and displayed to the operator in real-time to indicate both desired and actual performance levels on the tasks.

25.(U) Progress: 7710-7809. The tasking and measurement methodology developed to date was used to evaluate performance capabilities in multiple demand tasking situations with varying auditory/visual input requirements and verbal/manual output requirements.

(continued)

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Studies were also conducted to refine techniques for assessing performance under conditions of varying workload requirements and to investigate sources of task interference in combined-task performance. The results indicated that performance in a visual continuous control task is degraded less by concurrent demands from auditory as opposed to visual tasks and by the use of voice as opposed to manual control of simultaneously competing tasks. A performance operating characterisitc analysis technique was also demonstrated to be an excellent descriptive and analytical tool for assessing performance under conditions of altered priorities and workload. Additional work showed that stimulus and response coding in multiple demand situations can be a powerful source of task interference. These results strongly support previous assumptions that human voice can be used very effectively for command and control functions in complex system operations and point out important aspects which must be considered when tasks are defined and integrated. One study was published, three have been submitted for publication and other manuscripts are in preparation.

HE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
771001	D. CHANGE	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61153N	MR04101	MR0410103	NR 0154
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)**

(U) Determinants of visual acquisition

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

012900 Physiology 012400 Personnel selection and maintenance

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7710	8709	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 78	1.6	60
	CURRENT 79	1.7	68

19. RESPONSIBLE DOD ORGANIZATION 391584

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J.D. BLOOM, CAPT, MC, USN

TELEPHONE: AREA Code—202—295-1453

20. PERFORMING ORGANIZATION 406061

NAME:* Aerospace Psychology Department Naval Aerospace Medical

ADDRESS:* Research Laboratory NAS, Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* Goodson, J.E. CDR MSC USN (Ph.D.)

TELEPHONE: 904-452-2324

ASSOCIATE INVESTIGATORS

NAME: Morrison, T.R., LT MSC USN

NAME:

21. GENERAL USE C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Vision (U) Visual Acquisition (U) Dynamic Visual Acuity (U) Optokinetic (U) Accommodation (U) Visuomotor Mechanisms (U) CIVAPP (U) Human Subj.

23. TECHNICAL OBJECTIVE.* 24. APPROACH.* 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objective: Visual performance on many tasks required of naval personnel is primarily acquisition limited. The requirements to search for and track visual targets, scan visual displays, and respond to peripheral warning lights involve visual and visuomotor mechanisms about which little is known. The objective of this work unit is to develop information concerning visual acquisition, and the visual control of eye movements and accommodation necessary for acquisition, with applicability to the following: (1) assignment of personnel to jobs in which efficiency of visual acquisition is critical, (2) measuring and improving visual acquisition effectiveness, (3) design of acquisition tasks, (4) design of visually coupled systems, and (5) early diagnosis of retinal pathology.

24. (U) Approach: Psychophysical and physiological techniques will be utilized to investigate the relationship between stimulus parameters of size, contrast, distance and velocity to acquisition parameters of detection, tracking, accommodation and resolution. Established techniques will be utilized for measuring Dynamic Visual Acuity, Optokinetic Thresholds and accommodation. Initial investigations will address the nonlinear relation between target movement and visual acquisition, and will seek to differentiate the critical stimulus parameters for visual acquisiton from those for resolution. This work will result in hypotheses concerning mechanisms in the organization of the visual system which are specialized for acquisition. Later work will investigate these hypotheses by neurophysiological techniques. This research will provide baseline data for coordinated exploratory development work related to the above objectives.

(continued)

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25.(U)PROGRESS: (771001-780930) The optokinetic response is a reflexive, nystagmic eye movement response to a moving visual field. The classical interpretation has been that the slow phase of this response represents positional tracking, and that its failure at higher rates of field movement is due to "flicker fusion." Experiments have been completed which counter this interpretation, and document the occurence of repeatable threshold shifts in man and pigeon. Data collection is in progress to determine the relationships of luminance, field size and position, and stimulus size to these threshold shifts. It is hypothesized that the visual mechanisms controlling these responses are important in the visual acquisition process.

Our dynamic visual acuity (DVA) experiments require the subject to track and resolve the visual image of an acuity target observed through a plane rotating mirror. Target angular velocity and exposure time are controlled by mirror velocity and length, respectively. Although the non-linear relationship between target velocity and mirror velocity has been neglected by previous investigators, it is an important consideration in the present experiments. General expressions were derived which describe the target velocity as a function of mirror velocity, and target size as a function of mirror position. Analog circuits were developed to obtain desired stimulus management. Experiments were completed to determine the effects of luminance upon DVA. Exploratory experiments were completed to demonstrate that surround stimuli impact DVA performance. Data collection is underway to investigate the characteristics of surround stimuli which impact DVA performance.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	771001	DDR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	NEW	U	U	X	NA	☐ YES ☐ NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758			
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Development of Non Paper-Pencil Predictors of Aviation Performance in Training and Fleet.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) Personnel Selection, Training and Evaluation.

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7710	8109	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT FY78	2.8	266

19. RESPONSIBLE DOD ORGANIZATION

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

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20. PERFORMING ORGANIZATION 406061

NAME:* Aerospace Psychology Department
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PRINCIPAL INVESTIGATOR

NAME:* Griffin, Glenn R. GS-11

TELEPHONE: 904-452-3656

ASSOCIATE INVESTIGATORS

NAME: Mosko, James D., Ph.D. GS-13

NAME: Doll, Richard E. LCDR MSC USN

21. GENERAL USE M

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Prediction (U) Selection (U) Performance Assessment (U) Human Subjects.

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Objective: The objective of this research is the development and implementation of a program of non paper-pencil predictors of aviation performance, both at the training and fleet level. Such a development will enhance not only the efficiency of aviator selection and the Student Prediction System, but will improve the basis for platform assignments within the undergraduate training program and for the Replacement Training Squadron (RTS). Recent research literature has indicated that three non paper-pencil measures are worthy of such a research effort: viz., (1) selective attention, (2) voice analysis (as a measure of maladaption to stress), and (3) perceptual psychomotor performances.

(1) Selective Attention: Experts have agreed that abilities to manage information from several sources simultaneously, adapt quickly changing situations, and integrate, store, combine, and compare data input in the course of performing several tasks concurrently are all attributes conducive to aviator success. Previous research has demonstrated the effectiveness of selective attention tests in predicting flight training performance. This investigation will investigate a dichotic listening test similar to that developed and successfully validated by the Israeli Air Force for measuring selective attention capabilities.

(2) Voice Analysis as a Measure of Stress: A major reason for student voluntary withdrawal is expressed as stress or anxiety in the training environment. The research literature suggests that (1) high levels of anxiety cause performance decrement and subsequent attrition, and (2) that anxiety or stress is an expression of symptom of poor or inefficient performance in the flying training environment. Numerous research efforts have been conducted to analyze the relationship of anxiety and/or stress to Navy aviation

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attrition. These research efforts have been unsuccessful because an objective measure of stress or anxiety has not been available for use in research evaluation. The objective of this proposed research is to evaluate a new, objective and non intrusive method of stress measurement (voice analysis) to objectively measure stress and anxiety and determine the relationship of stress to human performance in aviation training.

(3) Perceptual Psychomotor Performance: Psychomotor testing has been shown to be related to aviator performance for a great number of years and was one of the best predictors of aviator success in the war years (WWII) in the Army Air Corps. However, the use of psychomotor testing was discontinued despite its unique contribution to aviator selection because of difficulty associated with the maintainability of psychomotor test hardware. Recently new solid state Perceptual, Psychomotor Test devices have been developed and have been shown to make added and unique contribution to the prediction of aviator success in the USAF. It is proposed that a number of these devices be procured and evaluated in the Navy aviation training program to determine their utility in the prediction of aviator performance.

24. (U) Approach: This research effort will obtain, on a substantial subject population, measures on all three non paper-pencil predictor variables. The relationship of these measures to training performance (both undergraduate and Replacement Training Squadron) and fleet performance will be examined. This examination will include a comparison of the predictive effectiveness of the subject non paper-pencil tests with and without the inclusion of presently used predictor variables.

(U) This is a new work unit.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DDR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. NEW	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)**

(U) Development of task-relevant tests predictive of aviation performance

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) Personnel Selection, Training and Evaluation

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7810	8109	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 78	0	0
	CURRENT 79	3.4	150

19. RESPONSIBLE DOD ORGANIZATION 391584

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J.D. BLOOM, CAPT. MC, USN

TELEPHONE: AREA Code—202— 295-1453

20. PERFORMING ORGANIZATION 406061

NAME:* Aerospace Psychology Department
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PRINCIPAL INVESTIGATOR

NAME:* Doll, R.E., CDR MSC USN (Ph.D.)

TELEPHONE: 904-452-3281

ASSOCIATE INVESTIGATORS

NAME: Griffin, G.R., GS-11

NAME: Mosko, J.D., GS-13 (Ph.D)
Acoustical Sciences Div.

NAME: Baisden, A.G. GS-9

21. GENERAL USE

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Prediction (U) Selection (U) Performance Assessment (U) Human Subjects

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23.(U) Objective: The objective of this work unit is the investigation into and development of performance oriented (vice paper-pencil)test procedures that will significantly relate to meaningful criteria of aviation performance. In addition it is anticipated that a data base will be developed for these performance oriented measures by age. With time such a data base will allow scores to be interpreted according to various age norms and provide a basis other than age, for making Service Group designations.

24.(U) Approach: This research effort will obtain on a substantial Navy population measures based on performance oriented tests. The first two measures to be investigated are:

1) Selective Attention:Experts have agreed that abilities to manage information from several sources simultaneously, adapt quickly to changing situations, and integrate, store, combine, and compare data inputs in the course of performing several tasks concurrently, are all attributes conducive to aviator success.

2) Perceptual Psychomotor Performance: Psychomotor testing has been shown to be related to aviator performance for a great number of years and was one of the best predictors of aviator success in the war years (WWII) in the Army Air Corps. However, the use of psychomotor testing was discontinued despite its unique contribution to aviator selection because of difficulty associated with the maintainability of the psychomotor test hardware. Recently new solid state Perceptual, Psychomotor Test devices have been developed and have been shown to make an added and unique contribution to the prediction of aviator success in the USAF. It is proposed that these devices be experimentally manipulated within a Navy aviation population.

25.(U) NA.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY	1.AGENCY ACCESSION* DN 877425	2.DATE OF SUMMARY* 781001	REPORT CONTROL SYMBOL DD-DR&E (AR) 636 (3900)

3.DATE PREV SUM'RY	4.KIND OF SUMMARY	5.SUMMARY SCTY*	6.WORK SECURITY*	7.REGRADING*	8a.DISB'N INSTR'N	8b.SPECIFIC DATA-CONTRACTOR ACCESS	9.LEVEL OF SUM
771001	H. TERMINATION	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10.NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	F51524	ZF51524004	5020
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)** (U) Relationship between divided attention capabilities and operational performance of Naval Aviation Candidates

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) 007500 Human Engineering

13.START DATE	14.ESTIMATED COMPLETION CATE	15.FUNDING AGENCY	16 PERFORMANCE METHOD
7710	7809 CONT.	DN	C. In-House

17.CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18.RESOURCES ESTIMATE	a.PROFESSIONAL MAN YRS	b.FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 77	0	0
FISCAL YEAR CURRENT 78	0.3	20

19.RESPONSIBLE DOD ORGANIZATION 391584

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J.D. BLOOM, CAPT, MC, USN

TELEPHONE: AREA Code—202— 295-1453

20.PERFORMING ORGANIZATION 406061

NAME:* Aerospace Psychology Department Naval Aerospace Medical Research Laboratory

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PRINCIPAL INVESTIGATOR

NAME:* North, R.A., Ph.D.

TELEPHONE: 904-452-3281

ASSOCIATE INVESTIGATORS

NAME: Owens, J.M., LT, MSC, USN

NAME: Harris, S.D., LT, MSC, USN

21. GENERAL USE M

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Human Performance (U) Psychological Simulation (U) Human Subjects

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Objective: Modern high performance aviation systems require operators to share attention between a number of concurrently competing task demands and to rapidly integrate large amounts of information. It is widely agreed that the ability to effectively manage information from several sources simultaneously is conducive to aviator success. New techniques are required to assess the divided attention capabilities of naval aviators in order to improve predictions concerning the likelihood of success in naval aviation training. This project is designed to evaluate the performance of naval aviation personnel in multiple demand task situations and to investigate the relationship between measures of divided measures of divided attention capabilities and operational performance in naval aviation training programs.

24. (U) Approach: The method used to assess divided attention capabilities involves the use of computer automated continuous control (tracking) and discrete information processing tasks. Adaptive task loading techniques are used in single-task performance sessions to adjust task difficulties to individual skill levels. Feedback displays are used in both separate- and combined-task conditions to provide on-line indications of both desired and actual performance levels. Initial efforts will examine the reliability of the obtained measures and their sensitivity to individual differences in divided attention capabilities. In subsequent work, the correlation between measures of time sharing capabilities and naval aviator performance scores in pilot training and naval flight officer training programs will be investigated.

(continued)

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25. (U) Progress: (7710-7809) A study was completed during this reporting period which demonstrated high test-retest reliabilities of measures of divided attention capabilities. Analyses of combined-task performance also revealed individual differences in the ability to rapidly time-share attention and effectively integrate information from simultaneously competing input sources. A correlational analysis showed no consistent relationships between single- or combined-task performance measures and scores on four paper-and-pencil tests traditionally administered to incoming aviation officer and naval flight officer candidates. The present performance measures, therefore, appear to be independent from attributes measured by written tests currently used for aviator selection purposes. An additional study will investigate the relationship between measures of divided attention capabilities and naval aviator performance during training flight operations. One technical report has been submitted for NAMRL publication. The project will be terminated due to the departure of the principal investigator and the transfer of one of the associate investigators.

H

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION *	2. DATE OF SUMMARY *	REPORT CONTROL SYMBOL
	78 10 01	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY *	6. WORK SECURITY *	7. REGRADING *	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
77 10 01	D. CHANGE	U	U	X	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES. *	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	F51524	ZF51524004	2011
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)**

(U) Visual acquisition functions in operational environments

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

012500 Personnel selection training and evaluation 007500 Human factors engineering

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
74 07	84 09	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER: *

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 78	.7	62
FISCAL YEAR CURRENT 79	1.5	166

19. RESPONSIBLE DOD ORGANIZATION 391584

NAME: * Naval Medical Research and Development Command

ADDRESS: * National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J.D. BLOOM, CAPT, MC, USN

TELEPHONE: AREA Code—202— 295-1453

20. PERFORMING ORGANIZATION 406061

NAME: * Aerospace Psychology Department Naval Aerospace Medical Research Laboratory

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PRINCIPAL INVESTIGATOR

NAME: * Goodson, J.E., CDR MSC USN (Ph.D.)

TELEPHONE: 904-452-2324

ASSOCIATE INVESTIGATORS

NAME: Hopson, J.A., Ph.D.

NAME: Morris, A., Ph.D.

Blower, D.J., LT MSC USNR (Ph.D.)

21. GENERAL USE

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Vision (U) Visual acquisition (U) Dynamic visual acuity (U) Optokinetic response (U) Accommodation (U) Human subjects

23. TECHNICAL OBJECTIVE. * 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objective: The current state of knowledge concerning the relationship between specific visual functions and the performance of operational tasks is critically deficient. New information is required in order to identify visual requirements for screening and/or training of aviation personnel, and to develop more effective criteria for human factors design requirements in operational systems. Further, the visual system is known to be sensitive to stressful conditions encountered in the operational environment. Data are not available for predicting or assessing the effects of environmental variables upon mission limiting visual functions. The objectives of this work unit are to define critical visual requirements in naval aviation, and to assess visual capabilities in the aviation community for meeting these requirements.

24. (U) Approach: This exploratory development work will extend and apply the data of coordinated work units sponsored by OPNAV and AIRSYSCOM. The relationships of existing visual tests to aviation performance requirements will be investigated. Psychophysical and physiological techniques will be utilized to develop new methods of assessing visual capabilities. Emphasis will be placed upon dynamic visual functions which currently are not being tested, and upon stimulus conditions which reflect conditions of the aviation environment. As methods are developed for assessing visual characteristics which are important to operational performance, these will be applied to determine distribution among naval aviation personnel, and to derive new visual screening requirements.

(continued)

*Available to contractors upon originator's approval

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2011
781001

25. (U) Progress: (771001-780930) The initial version of the Vision Test Battery has been completed, and is operational in a manual model. This battery includes static and dynamic tests of central and peripheral visual functions under high and low contrast conditions. Data collection was completed during this year to resolve design and methodology issues regarding the following: methods of presenting stimuli for each test, quality control of stimuli, method of controlling contrast, ranges of target sizes required, and testing time and procedures for each test.

These tests will be validated against intermediate criteria in the Visual Detection Simulator, inflight air-to-air target acquisition (joint AIR 6.3), and training performance. Data collection was completed to assess physical and psychometric characteristics of target slides for the Visual Detection Simulator.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	761001	DD-DR&E(AR) 636(3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Hematologic and biochemical alterations in low pressure chamber workers following operational exposure to hypobaric environments

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

016200 Stress physiology 002300 Biochemistry 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	7809	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:* NA

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 77	0.2	10

19. RESPONSIBLE DOD ORGANIZATION 406061

NAME:* Naval Aerospace Medical Research Laboratory

ADDRESS:* Pensacola, Florida 32508

RESPONSIBLE INDIVIDUAL

NAME: MITCHEL, R.E. CAPT MC USN

TELEPHONE: AREA Code-904-452-3286 Autovon 922-3286

20. PERFORMING ORGANIZATION 406061

NAME:* Aviation Medicine Division
Naval Aerospace Medical Res. Lab.

ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* BASON, R. LT MSC USN

TELEPHONE: 904-452-2157 Autovon 922-2157

ASSOCIATE INVESTIGATORS

NAME: KUPPER, J. LTCOL USAF VC

NAME: DULLY, F.E. CAPT MC USN

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Aviators' bends (U) Hypobaric (U) Decompression sickness

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) By means of a series of analyses of blood samples from low pressure chamber workers and trainees, identify those compounds of the blood that are sensitive to hypobaric exposures. Hematologic and biochemical indicators of the degree of decompression insult would be useful in studying the cause of decompression sickness as well as diagnostically valuable in establishing the presence, extent, or absence of the disease. Changes in blood values have been reported in man and experimental animals following decompression from hyperbaric environments, even when overt signs of decompression sickness were not evident. Similar studies of hypobaric decompression have not been documented.

24. (U) The approach is to withdraw venous blood samples from low pressure chamber workers and trainees before and after they are exposed to hypobaric pressures in the course of performing their assigned duties and training. A battery of clinicopathologic determinations will be done on each sample and appropriate statistical comparisons made between pre- and post-exposure values.

25. (U) NA.

**Available to contractors upon originator's approval*

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION *	2. DATE OF SUMMARY *	REPORT CONTROL SYMBOL
	761001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY *	6. WORK SECURITY *	7. REGRADING *	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES: *	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

(U) Male and female strength measurements relative to aircraft control activity

12. SCIENTIFIC AND TECHNOLOGICAL AREAS * 00200 Human operator control characteristic & performance 01950 Control devices and equipment 007500 Human factors engineering

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	7709	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: NA EXPIRATION:

b. NUMBER: *

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 77	0.1	6

19. RESPONSIBLE DOD ORGANIZATION 406061

NAME: * Naval Aerospace Medical Research Laboratory

ADDRESS: * Pensacola, Florida 32508

RESPONSIBLE INDIVIDUAL

NAME: MITCHEL, R.E. CAPT MC USN

TELEPHONE: AREA Code– 904-452-3286 Autovon 922-3286

20. PERFORMING ORGANIZATION 406061

NAME: * Aviation Medicine Division Naval Aerospace Medical Research Laboratory, Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME: * BASON, R. LT MSC USN

TELEPHONE: 904-452-2157 Autovon 922-2157

ASSOCIATE INVESTIGATORS

NAME: GREGOIRE, H. LCDR MSC USN

NAME:

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Strength measurements (U) Aircraft control resistance

23. TECHNICAL OBJECTIVE, * 24. APPROACH, 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23 (U) The primary purpose of this study will be to ascertain maximal strength capabilities for various cockpit controls for both males and females.

24 (U) Fifty male aviation officer candidates and fifty females anthropometrically and age qualified for aviation from NAS Pensacola will be utilized for this study. Maximal strength capabilities for various control activities, i.e., yoke, stick, collective, rudder and canopy release will be determined for one minute duration.

25 (U) NA.

**Available to contractors upon originator's approval*

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	770930	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
761001	K. Completion	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	MF51.524	.005	7026
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Investigation of causes of military aircraft accidents involving pilot vertigo/disorientation

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 002400 Bioengineering; 001300 Aircraft; 016200 Stress Physiology; 009400 Man-Machine Relations; 006000 Escape, Rescue, Survival

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7307	7709	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 76 + TQ	1.9	136
FISCAL YEAR CURRENT 77	1.0	50

19. RESPONSIBLE DOD ORGANIZATION 391586
NAME:* Naval Medical Research & Development Command
ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME: OHSLUND, R.K. CAPT MC USN
TELEPHONE: AREA Code—202— 295-1525

21. GENERAL USE C

20. PERFORMING ORGANIZATION 406061
NAME:* Bioenvironmental Engineering Div.
Biological Sciences Dept.
ADDRESS:* Naval Aerospace Medical Res. Lab.
Pensacola, FL 32508

PRINCIPAL INVESTIGATOR
NAME:* Hixson, W. C.
TELEPHONE: 904-452-4456

ASSOCIATE INVESTIGATORS
NAME: Guedry, F. E., Jr., Ph.D.
NAME: 904-452-2541

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U)Aviation Medicine; (U)Aviation Safety; (U)Aircraft Accidents; (U)Spatial Disorientation; (U)Combat Operations; CIVAPP(U)Spatial Disorientation Accidents

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23(U) This project has been a joint Army/Navy research effort to quantitatively establish the incidence, cost, and probable operational causes of military aircraft accidents involving either overt or covert spatial disorientation experiences of the accident pilots.

24(U) Since this problem was of mutual concern to the Army and to the Navy, the US Army Agency for Aviation Safety in liaison with the US Army Aeromedical Research Laboratory made available its extensive master accident files for a detailed case-history analysis of orientation-error (O-E) accidents that occurred in both Vietnam and locations elsewhere. A classification system was developed to identify such accidents and applied to the investigation of all Regular Army aircraft accidents that occurred over a five-year period.

25(U) As a direct result of this joint Army/Navy effort, fifteen NAMRL-USAARL reports and one AGARD report have been published that detail the results of the longitudinal study on a fiscal year basis. Numerous consultative visits and meetings with USAAVS and USAARL investigators have resulted in the application of the project findings to the investigation of specific aircraft accidents and the development of related accident-prevention recommendations. As will be detailed in a summary report, orientation-error accidents that occurred in Army aircraft during the study period played a most significant role in the over-all accident statistics: These accidents accounted for 10% of all pilot-error accidents and 7% of all accidents regardless of cause; fatal orientation-error accidents accounted for 24% of all fatal pilot-error accidents and 16% of all fatal accidents of all types. For the first time, quantitative incidence data are available which show that the hazard of orientation error in RW aircraft, particularly during combat operations, is at least equal to that of FW aircraft in Army Aviation.

*Available to contractors upon originator's approval (761001 to 770930)

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1.AGENCY ACCESSION*	2.DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DD-DR&E (AR) 636 (3900)

3.DATE PREV SUM'RY	4.KIND OF SUMMARY	5.SUMMARY SCTY*	6.WORK SECURITY*	7.REGRADING*	8a.DISB'N INSTR'N	8b.SPECIFIC DATA-CONTRACTOR ACCESS	9.LEVEL OF SUM
771001	D. CHANGE	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10.NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	F51524	ZF51524005	7031
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Prevention of motion sickness in flight training by transfer of adaption effects acquired in the laboratory.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
016200 Stress physiology 012600 Pharmacology 009400 Man-machine relations

13.START DATE	14.ESTIMATED COMPLETION CATE	15.FUNDING AGENCY	16 PERFORMANCE METHOD
7610	8209	DN	C. In-House

17.CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18.RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 78	0.1	40
FISCAL YEAR CURRENT 79	0.1	49

19.RESPONSIBLE DOD ORGANIZATION 391584
NAME:* Naval Medical Research and Development Command
ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014
RESPONSIBLE INDIVIDUAL
NAME: J.D. BLOOM, CAPT, MC, USN
TELEPHONE: AREA Code—202—295-1453

20.PERFORMING ORGANIZATION 406061
NAME:* Biological Sciences Department
ADDRESS:* Naval Aerospace Medical Research Laboratory NAS, Pensacola, Fl. 32508
PRINCIPAL INVESTIGATOR
NAME:* GRAYBIEL, A., M.D.
TELEPHONE: 904-452-3255
ASSOCIATE INVESTIGATORS
NAME:
NAME:

21. GENERAL USE
M

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Motion sickness susceptibility (U) Assessment (U) Transfer of adaptation (U) Vestibular systems (otolithic and canalicular) (U) Human subjects

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. TECHNICAL OBJECTIVE (U) Resolution of problems posed by flyers experiencing nausea and vomiting in flight maneuvers.

24. APPROACH (U) The approach will feature performance in a slow rotation room (SRR) that makes a distinction between flyers who should be permanently grounded and flyers who vary in the likelihood of success after restoration of flight status. The crucial measurment in the SRR are rates of adaptation to cross-coupled angular accelerations during counterclockwise rotation and the extent to which the adaptation transfers to the unpracticed (clockwise) direction of rotation. Insofar as feasible, referrals for treatment will be exposed, concomitantly, to appropriately stressful flights in aircraft.

25. PROGRESS (U) (770415-780415) Recent reports deal with the background on which this project is based (Annex 1) and a detailed follow-up report (Annex 2) on our first ten consecutive referrals. The former points up the stages in which bidirectional adaptation to cross-coupled angular accelerations may be achieved in a slow rotation room by executing head movements in one quadrant during unidirectional rotation. This "transfer" from counterclockwise to clockwise rotation is a measure of the transfer of adaptation from laboratory to flight maneuvers. Among the first ten referrals there was no opportunity to attempt treatment in two; decisive evidence for permanent grounding was obtained by exploiting the potentialities of the SRR in two more. One referral after completing flight training was not assigned to a duty squadron for nearly 5 months. After becoming sick in his first flight (F-104) he submitted a request to be removed from duty involving flying. Cost effectiveness was demonstrated in the remaining five (62.5% of the cases in whom adaptation was attempted); when recently contacted, the follow-up periods (in flight status) ranged from 10 to 27 months.

**Available to contractors upon originator's approval*

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1.AGENCY ACCESSION*	2.DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DD-DDR&E (AR) 636 (3990)

3.DATE PREV SUM'RY	4.KIND OF SUMMARY	5.SUMMARY SCTY*	6.WORK SECURITY*	7.REGRADING*	8a.DISB'N INSTR'N	8b.SPECIFIC DATA CONTRACTOR ACCESS	9.LEVEL OF SUM
771001	C. CHANGE	U	U	X	NL	X YES ☐ NO	A. WORK UNIT

10.NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	F51524	ZF51524004	9022
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)**

(U) Sensory interactions affecting human performance in naval motion environments

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

012900 Physiology; 013400 Psychology; 002400 Bioengineering; 009400 Man/Machine relations

13.START DATE	14.ESTIMATED COMPLETION CATE	15.FUNDING AGENCY	16 PERFORMANCE METHOD
7710	8209	DN	C. In-House

17.CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18.RESOURCES ESTIMATE	a.PROFESSIONAL MAN YRS	b.FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 78	1.6	80
FISCAL YEAR CURRENT 79	1.7	165

19.RESPONSIBLE DOD ORGANIZATION 391584

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J.D. BLOOM, CAPT, MC, USN

TELEPHONE: AREA Code—202— 295-1453

20.PERFORMING ORGANIZATION 406061

NAME:* Biological Sciences Department Naval Aerospace Medical Research Laboratory, NAS Pensacola, FL 32508

PRINCIPAL INVESTIGATOR

NAME:* HIXSON, W.C., MSEE

TELEPHONE: 904-452-4456

ASSOCIATE INVESTIGATORS

NAME: GUEDRY, F. E., Ph.D.

NAME: 904-452-2541

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Human subjects; (U)Airsickness; (U)Seasickness; (U) Spatial disorientation;(U)Crew performance; (U) Sensory mechanisms;(U)CIVAPP:Otoneurology

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23.TECHNICAL OBJECTIVE (U):Efficient reactions to motion are normally dependent upon correlated inputs from each of several motion sensors. Aircraft, ship, and simulator motions frequently induce uncorrelated and/or dissonant inputs from these sensors. In such situations, responses are often inappropriate to the state of motion, thereby increasing the probability of control errors, perceptual errors, and motion sickness. The objective of this project is to investigate interactions among visual, vestibular, tactile, and proprioceptive systems in order to develop predictive principles and reference data that will be useful in optimizing crew performance in Navy motion environments.

24. APPROACH (U):Dynamic response data for different motion sensors will be used to select combinations of motion stimuli that yield 1) correlated sensory inputs, and 2) uncorrelated or discordant sensory inputs. Selected stimuli will be presented to determine 1) sets that enhance performance and improve accuracy of perceived spatial orientation, and 2) sets that produce inappropriate and inefficient responses. Input/output descriptions of perceptual, sensory-motor, nauseotypic, and performance responses to interacting motion stimuli will be generated and considered in relation to ship and aircraft operations.

25.PROGRESS (U):(771001-780415) Visual-vestibular interaction experiments revealed mechanisms controlling disorientation stress and nausea. A second series revealed interactions controlling visibility of head-fixed displays (possibly relevant to heads-up displays). Investigations of the effect of proprioception on perceptual-motor responses to motion suggest that voluntary control of motion alters proprioceptive influence on vestibular responses. Each series yielded results relevant to predicting perceptual, motor, and nauseotypic responses in motion simulators and real motion environments. Two papers were published, two talks were given, and a chapter describing fundamental mechanisms of sensory interactions relevant to this work unit was published.

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	771001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. NEW	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				NR
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

(U) Exercise electrocardiography in aviators; long term follow-up of the 1000 aviators.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

003500 Clinical Medicine 016200 Stress Physiology 012400 Personnel Selection & Maint.

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7710	7809 CONT.	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER: *

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 78	0.3	28

19. RESPONSIBLE DOD ORGANIZATION 391586

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: OSHLUND, R. K., CAPT MC USN

TELEPHONE: AREA Code—202— 295-1525

20. PERFORMING ORGANIZATION 406061

NAME:* Medical Sciences Department
Naval Aerospace Medical Research Laboratory

ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* MAC INTYRE, N. R., LCDR MC USNR

TELEPHONE: (904) 452-2157

ASSOCIATE INVESTIGATORS

NAME: MITCHEL, R. E., CAPT MC USN

NAME: GRAYBIEL, A., MD, GS-18

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) CIVAPP: Cardiac Diagnosis (U) CIVAPP: Coronary Artery Disease (U) CIVAPP: Exercise Electrocardiography

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objective. Ischemic heart disease statistics from civilian data show an annual incidence of coronary artery disease of about one percent in American men in their 40's. To the physician dealing with aviation medicine, a more important statistic is that sudden death is the FIRST symptom in fifteen percent of this group. Therefore, it is essential to aviation safety to identify the pilot with coronary disease as early as possible. Exercise electrocardiography is a potentially useful tool. Several year followups of initially asymptomatic, non-aviation populations have demonstrated the effectiveness of this procedure to identify subjects who develop clinical disease. Long term followup statistics on large numbers of asymptomatic aviators who undergo routine exercise electrocardiography are lacking.

24. (U) Approach. The U.S. Navy's Aerospace Medical Research Laboratory has just such a unique data bank. One thousand fifty-six healthy student aviators were first seen in 1940. The average age was 23. In 1958, at average age 41, 455 of 700 subjects seen in followup were given a Double Masters Exercise Test in addition to the usual workup. In 1963, at average age 46, all 705 subjects seen in followup underwent the Harvard Step Test in addition to the usual workup. In 1969, at average age 51, all 675 subjects seen in followup underwent Bruce Protocol Treadmill Testing in addition to the usual workup. Obvious coronary artery disease in 1963, 1969, and 1977 (from a proposed questionnaire) will be the end points of the analyses. The variables will include the results of the various exercise tests and the relationship of other Risk Factors such as cigarette habits, blood pressure elevations, and hypercholesterolemia. The goal is to define the sensitivity, specificity, predictive value, and relative risk of various exercise tests in 40-50 year old aviators over a seven to eighteen year followup.

25. (U) Progress. NA.

**Available to contractors upon originator's approval*

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	780801	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
771001	K. COMPLETION	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	F51524	ZF51524005	7033
b. CONTRIBUTING	0	0		
c. CONTRIBUTING	0	0		

11. TITLE *(Precede with Security Classification Code)**

(U) Exercise electrocardiography in aviators: long term follow-up of the 1000 Aviators

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 012400 Personnel selection and maintenance
03500 Clinical medicine 016200 Stress physiology

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7710	7808	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 77	0	0
	CURRENT 78	0.3	17

19. RESPONSIBLE DOD ORGANIZATION 391584

NAME:* Naval Medical Research and Development Command
ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME: J. D. BLOOM, CAPT MC USN
TELEPHONE: AREA Code—202— 295-1453

20. PERFORMING ORGANIZATION 406061

NAME:* Medical Sciences Department Naval Aerospace Medical Research Laboratory
ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* MAC INTYRE, N. R., LCDR MC USNR
TELEPHONE: 904-452-2157

ASSOCIATE INVESTIGATORS
NAME: MITCHEL, R. E., CAPT MC USN
NAME: GRAYBIEL, A., M.D., GS-18

21. GENERAL USE
C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) CIVAPP: Cardiac diagnosis (U) CIVAPP: Coronary artery disease (U) CIVAPP: Exercise electrocardiography

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. TECHNICAL OBJECTIVE. (U) It is essential to aviation safety to identify the pilot with coronary disease as early as possible. Exercise electrocardiography is a potentially useful tool. Several year follow-ups of initially asymptomatic, non-aviation populations have demonstrated the effectiveness of this procedure to identify subjects who develop clinical disease. Long term follow-up statistics on large numbers of asymptomatic aviators who undergo routine exercise electrocardiography are lacking.
24. APPROACH. (U) One thousand fifty-six healthy student aviators were first seen in 1940. The averag age was 23. In 1958, at average age 41, 455 of 700 subjects seen in follow-up were given a Double Masters Exercise Test. In 1963, at average age 46, all 705 subjects seen in follow-up underwent the Harvard Step Test. In 1969, at average age 51, all 675 subjects seen in follow-up underwent Bruce Protocol Treadmill Testing. Coronary artery disease in 1977 (from questionnaire) was the end point of the analyses. The goal was to define the sensitivity, predictive value, and relative risk of various exercise tests in 40-50 year old aviators over a seven to eighteen year follow-up.
25. PROGRESS. (U) (7710 to 7804) The sensitivity, specificity, predictive value and relative risk for the 3 exercise protocols were defined in both the 1000 Aviator group as a whole and in a subgroup who had additional risks for coronary disease. Results available in: 1) Manuscript "Longevity in Military Pilots, 37 year followup of the 1000 Aviators" submitted for publication in Aviation Space and Environmental Medicine, March 1978. 2) Preservation "Exercise electrocardiograms in military pilots, 8-19 year follow-up of the 1000 Aviators" given at the Aerospace Medical Association meeting in May 1978.

*Available to contractors upon originator's approval

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	77 09 30	DD-DR&E(AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
761001	H. Termination	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	MF51524	005	5007
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)**

(U) Long term follow-up of the physical status of 1000 Naval aviators

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 012500 Personnel Selection, Training & Evaluation, 016200 Stress Physiology, 003500 Clinical Medicine

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
5006	7709	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 76 + TQ	0.1	10
	CURRENT 77	0.2	17

19. RESPONSIBLE DOD ORGANIZATION 391586

NAME:* Naval Medical Research & Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: OHSLUND, R.K., CAPT MC USN

TELEPHONE: AREA Code—202—295-1525

20. PERFORMING ORGANIZATION 406061

NAME:* Medical Sciences Department
Naval Aerospace Medical Research Laboratory

ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* MITCHEL, R.E., CAPT MC USN

TELEPHONE: 904-452-2157

ASSOCIATE INVESTIGATORS

NAME: GRAYBIEL, A., M.D., GS-18

NAME: MAC INTYRE, N.R., LCDR MC USNR

21. GENERAL USE

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) CIVAPP: Coronary Heart Disease (U) CIVAPP: Medical Statistics (U) Aviation Med.

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23 (U) Technical Objective. To provide data from the 1000 Aviator Study which will allow the establishment of more realistic physical standards for aviation and to provide methods of early prediction of alterable or preventable conditions with the ultimate goal of extending the useful life of the naval aviator.

24 (U) Approach. A unique study of aging in a pilot population, consisting of naval aviators, was started in 1940. Subsequent to the initial examinations the members of group were re-examined in 1952, 1958, 1964, and 1969, the data from each reassessment contributing to a three decade study, the longest study ever made on a pilot population.

25 (U) Progress. (760101-770930)

1) Placement in computer files of most of data collected 1940-1969. Data also edited and monograph with complete frequency distribution of major variables in preparation.

2) Updating of current status of the group via followup questionnaire. Mortality rate remains well below civilian actuarial tables.

3) Analysis of pulmonary function again patterns in aviators completed and abstract submitted to AGARD panel meeting. Results show significant slowing of lung aging in pilots.

Termination of project caused by lack of resources for additional followup exams. Project will be continued through separate data analyses.

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	74 07 01	DD-DR&E 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. New	U	U	N/A	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) A study of the physical status of a group of normal men matched with a group of repatriated prisoners of war.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

003500 Clinical medicine

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
74 06	79 06	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:* N/A

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING	-	-
CURRENT	0.2	82

19. RESPONSIBLE DOD ORGANIZATION

NAME:* Naval Aerospace Medical Research Laboratory

ADDRESS:* Naval Aerospace Medical Institute
Naval Aerospace & Regional Medical Ctr.
Pensacola, Florida 32512

RESPONSIBLE INDIVIDUAL

NAME: ALLEBACH, N.W., CAPT MC USN

TELEPHONE: AREA Code-904-452-3286 Autovon: 922-3286

20. PERFORMING ORGANIZATION

NAME:* Medical Sciences Department
Naval Aerospace Medical Res. Lab.

ADDRESS:* Naval Aerospace & Regional Medical Center, Pensacola, Florida 32512

PRINCIPAL INVESTIGATOR

NAME:* MITCHEL, R.E., CAPT MC USN

TELEPHONE: 904-452-2157 Autovon: 922-2157

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Medical statistics (U) Aviation medicine

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) To provide data from a group of normal men, matched as to age, rank and experience, for comparison with the one hundred sixty three repatriated prisoners of war.

24. (U) Because little is known relative to the effects of the prisoners of war experience, a long range follow-study of the one hundred sixty three repatriated prisoners of war has been initiated. However, in order to have a meaningful baseline from which to work, a control group is considered essential. It is this control group which is being proposed by this work unit.

25. (U) A new work unit.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	761001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) A study of the physical and psychiatric status of a group of repatriated prisoners of war

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
003500 Clinical medicine

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	8006	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:* NA
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING	-	-
CURRENT	0.5	40
77		

19. RESPONSIBLE DOD ORGANIZATION
NAME:* Naval Aerospace Medical Research Laboratory
ADDRESS:* Pensacola, Florida 32508

RESPONSIBLE INDIVIDUAL
NAME: MITCHEL, R.E., CAPT MC USN
TELEPHONE: AREA Code— 904-452-3286 Autovon:922-3286

20. PERFORMING ORGANIZATION
NAME:* Medical Sciences Department
Naval Aerospace Medical Res. Lab.
ADDRESS:* Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* MITCHEL, R.E., CAPT MC USN
TELEPHONE: 904-452-2157 Autovon: 922-2157

ASSOCIATE INVESTIGATORS
NAME: O'CONNELL P.F., CAPT MC USN
NAME:

21. GENERAL USE
M

22. KEYWORDS *(Precede EACH with Security Classification Code)*
(U) Medical statistics (U) Aviation medicine

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) To provide longitudinal physical and psychiatric data from a group of men who were prisoners of war as a result of the Viet Nam conflict and who were returned to United States control early in 1973.

24. (U) Because little is known relative to the effects of the prisoner of war experience, a long-range follow-up study of the one hundred seventy-eight repatriated prisoners of war has been initiated. One hundred sixty-eight of the men were examined by the Naval Aerospace Medical Institute in 1974, 1975, and 1976. The project has now been moved to the Naval Aerospace Medical Research Laboratory and it is this transfer which is established by this work unit.

25. (U) NA

*Available to contractors upon originator's approval

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DD-DR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
771001	D. Change	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) A study of the physical and psychiatric status of a group of repatriated prisoners of war

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

003500 Clinical medicine

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7610	8409	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 78	0.7	40
FISCAL YEAR CURRENT 79	0.7	54

19. RESPONSIBLE DOD ORGANIZATION 391586

NAME:* Naval Medical Research & Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J.D. BLOOM, CAPT MC USN

TELEPHONE: AREA Code—202—295-1453

20. PERFORMING ORGANIZATION 406051

NAME:* Medical Sciences Department
Naval Aerospace Medical Res. Lab.

ADDRESS:* NAS, Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR

NAME:* MITCHEL, R. E., CAPT MC USN

TELEPHONE: 904-452-2157

ASSOCIATE INVESTIGATORS

NAME: O'CONNELL, P. F., CAPT MC USN

NAME:

21. GENERAL USE M

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Medical Statistics (U) Aviation Medicine (U) Human Subjects

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. TECHNICAL OBJECTIVE (U) To provide longitudinal physical and psychiatric data from a group of men who were prisoners of war as a result of the Viet Nam conflict and who were returned to United States control early in 1973.

24. APPROACH (U) Because little is known relative to the effects of the prisoner of war experience, a long-range follow-up study of the one hundred seventy-eight repatriated prisoners of war was initiated. The study includes intensive physical, psychiatrical, and sociological examinations, with the major emphasis on detecting illness which might be related to the captivity experience. The program, started at Naval Aerospace Medical Institute, was moved to Naval Aerospace Medical Research Laboratory in 1976 and it is this transfer which is continued by this work unit.

25. PROGRESS (U) (770401-780401) One hundred sixty-eight of the men were examined in 1974, 1975, 1976, and 1977, utilizing the standard format established at the inception of the study. A significant number of abnormalities (physical, psychiatrical, and biochemical) have been found in the group. The implications of the findings will be known only after continued study of the men. No technical reports have been published during the reporting period. Data is now being analyzed, however, for the purpose of reporting the health trends of the group for the first five years of follow-up.

**Available to contractors upon originator's approval*

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1.AGENCY ACCESSION*	2.DATE OF SUMMARY*	REPORT CONTROL SYMBOL
777278	761001	DD-DR&E (AR) 636 (3900)

3.DATE PREV SUM'RY	4.KIND OF SUMMARY	5.SUMMARY SCTY*	6.WORK SECURITY*	7.REGRADING*	8a.DISB'N INSTR'N	8b.SPECIFIC DATA-CONTRACTOR ACCESS	9.LEVEL OF SUM
NA	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10.NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	MF51.524	005	7032
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Incidence and costs of airsickness in naval aviation

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 016200 Stress Physiology; 012400 Personnel Selection and Maintenance; 012500 Personnel Selection, Training and Evaluation

13.START DATE	14.ESTIMATED COMPLETION CATE	15.FUNDING AGENCY	16 PERFORMANCE METHOD
7610	7909	DN	C. In-House

17.CONTRACT/GRANT
a. DATES/ EFFECTIVE: N/A EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18.RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING		
FISCAL YEAR CURRENT 77	1.5	75

19.RESPONSIBLE DOD ORGANIZATION 406061
NAME:* Naval Aerospace Medical Research Laboratory
ADDRESS:* Pensacola, Florida 32508

RESPONSIBLE INDIVIDUAL
NAME: MITCHEL, R.E., CAPT MC USN
TELEPHONE: 904-452-3286 Autovon: 922-3286

20.PERFORMING ORGANIZATION 406061
NAME:* Perceptual & Behavioral Sciences Division
ADDRESS:* Naval Aerospace Medical Res. Lab. Pensacola, Florida 32508

PRINCIPAL INVESTIGATOR
NAME:* GUEDRY, F.E., Jr. GS-15
TELEPHONE: 452-2541 Autovon: 922-2541

ASSOCIATE INVESTIGATORS
NAME: HOLTZMAN, G.L. CDR MC USN
NAME: O'CONNELL, P.F., CAPT MC USN;
NAME: HIXSON, W.C.

21. GENERAL USE M

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Airsickness; (U) Aviation Medicine; (U) Stress Tolerance; (U) Performance Degradation; (U) Naval Aviation

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23(U) The immediate aim of this project is to document the incidence and cost of the airsickness problem in naval aviation. A recent pilot study of NFO trainees suggests that airsickness accounts for a larger proportion of student attritions than has been suspected heretofore. Related evidence indicates significant additional costs from repeated hops, extensive medical and psychological evaluation, treatment programs, etc., all resulting in increased time to train. It is expected that availability of incidence and cost data will permit the judicious selection of remedial options appropriate to the achieved level of training.

24(U) Initial priority will be placed on conducting a longitudinal study of airsickness in NFO trainees as they pass from VT-10 Basic Training through VT-86 Advanced Training to selected assignments in Replacement Air Groups. Airsickness incidence and severity data along with performance degradation measures will be obtained from each student and each instructor for each training hop over the entire training period. To establish a firm statistical background, it is planned to follow 10-12 consecutive NFO classes so as to achieve a minimum N of 200 students and 8,000 hops. Airsickness incidence will be related to particular hops, individual order of hops received, delays in training, seasonal variations in turbulence, and over-all student performance. Other data to be collected include case-by-case reasons for attrition, costs of attrition, costs for repeated hops, adaptation histories of airsick individuals, and relationship between degree of airsickness and performance degradation and/or attrition.

25(U) New.

**Available to contractors upon originator's approval*

4E

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	74 07 01	DD-DR&E (AR) 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
N/A	A. NEW	U	U	N/A	NN	☐ YES ☒ NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61153N	MR041.01	.01	0145
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

(U) Determination of Physiological Criteria for Design of Visual Display Devices

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) 019600 Display Devices & Equipment, (U) 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
74 07	79 06	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:* N/A

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 74	.4	15
	CURRENT 75	1.0	45

19. RESPONSIBLE DOD ORGANIZATION

NAME:* Bureau of Medicine and Surgery

ADDRESS:* Washington, D.C. 20372

RESPONSIBLE INDIVIDUAL

NAME: Brodine, C.E., Capt., MC, USN (BuMed 71)

TELEPHONE: AREA Code–202–254-4361

20. PERFORMING ORGANIZATION

NAME:* NAVAL AIR DEVELOPMENT CENTER
CREW SYSTEMS DEPARTMENT

ADDRESS: WARMINSTER, PA. 18974

PRINCIPAL INVESTIGATOR

NAME:* Chisum, Gloria T., Ph.D.

TELEPHONE: (215) 672-9000, Ext. 2439

ASSOCIATE INVESTIGATORS (SSN) 577-46-0004

NAME:

NAME:

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Displays, (U) Optics, (U) Vision

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objectives. To determine the physiological capabilities and limitations of the human visual system under airborne operational conditions requiring the use of advanced display devices, and to specify the visual criteria which the designs of advanced display devices must meet. The criteria must be enumerated in such a fashion that they can be readily used by the engineers and physical scientists who design and develop the displays.

24. (U) Approach. Physiological assessment of the visual system in terms of adaptation, acuity, accommodation and sensitivity will be conducted. Basic laboratory techniques will be used to assess the visual capabilities. Design criteria and constraints for visual sighting, tracking and detection devices will be established. The criteria established will be used by designers of the advanced display devices.

25. (U) Progress. (Dec 72-Dec 73) A literature search in preparation for development of a research plan is underway as an in-house Independent Research effort. The preparation is expected to be complete and the plan developed by June 1974.

*Available to contractors upon originator's approval

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	740701	DD-DR&E (AR) 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
NA	T. Proposed	U	U	N/A	MM	☐ YES ☐ NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				CCCC
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Determination of Thermal Requirements of Aircrew Personnel Equipped with Mission-Specific Personal Protective Systems in Extreme Environmental Conditions

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) 013300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
74 07	79 06	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 74	0.	.0
	CURRENT 75	0.2	32.0

19. RESPONSIBLE DOD ORGANIZATION

NAME:* Bureau of Medicine and Surgery
Washington, D.C. 20372

ADDRESS:*

RESPONSIBLE INDIVIDUAL

NAME: Brodine, C.E. CAPT, MC, USN (BUMED 71)

TELEPHONE: AREA Code–202– 254-4361

20. PERFORMING ORGANIZATION

NAME:* NAVAL AIR DEVELOPMENT CENTER
CREW SYSTEMS DEPARTMENT

ADDRESS:* WARMINSTER, PA. 18974

PRINCIPAL INVESTIGATOR

NAME:* Santa Maria, L.J. (403101)

TELEPHONE: 215-755-3228

ASSOCIATE INVESTIGATORS

NAME: COOPER, T.M. LT, MSC, USN (403103)

NAME: 215-755-3228

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Protective Suit Assemblies; (U) Thermal Protection

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objective. To determine the thermal requirements for the physiological protection of aircrew personnel exposed to environmental extremes during routine operational and emergency survival conditions. Information is used in the modification of thermal protective systems toward the safety and survival of aircrewmen in stressful environmental conditions.

24. (U) Approach. In order to attain the stated objective, a group of volunteer subjects, appropriately equipped with standard or experimental protective gear, will be exposed to different environmental conditions while noting various physiological responses and subjective reactions. Information gleaned from the sub-studies involving a broad environmental spectrum will be put in a form useful to the design of personal protective aircrew systems. The plan of the overall program will be: a) simulation of the operating or emergency environment expected under conditions of heat, dry cold and cold water immersions; b) application of physiological sensoring devices for the measurement of body temperature (skin and rectal) and heart rate; and c) exposure of the selected subjects equipped with protective suit assemblies for a fixed test duration oriented pre-set physiological end points are reached in the course of exposure.

25. (U) Progress: None. This is a new work unit intended to supply physiological data in questions concerning the thermal protection of aircrew members using standard or experimental protective suit systems in different environmental operating or emergency conditions.

**Available to contractors upon originator's approval*

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	781001	DD-DR&E (AR) 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
N/A	A. NEW	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

(U) Eye Movement as an Indicator of Visual Work Overload in Aircrew Personnel

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

012900 Physiology; 013400 Psychology

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7810	8309	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 78	0	0
	CURRENT 79	0.15	30.0

19. RESPONSIBLE DOD ORGANIZATION 391548

NAME:* Naval Medical Research and Development Command

ADDRESS:* Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: Ohslund, R.K., CAPT MC USN

TELEPHONE: AREA Code—301-295-1525

20. PERFORMING ORGANIZATION 406610

NAME:* Naval Air Development Center Aircraft & Crew Sys Tech Dir

ADDRESS:* Warminster, PA 18974

PRINCIPAL INVESTIGATOR

NAME:* Chisum, G.T., Ph.D. (60231)

TELEPHONE: 215-441-2439

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Human Subjects; (U) Vision; (U) Work Load; (U) CIVAPP: - Visual Performance

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objective: To determine the physiological capabilities and limitations of the human visual system under airborne operational conditions in which a heavy visual workload is present. The requirement for this work was established by Naval Research Code PA-6 of the FY-74 Naval Aviation Biomedical/Human Effectiveness Technical Workshop Report.

24. (U) Approach: The quality and magnitude of eye movements will be measured and related to the visual workload and performance under conditions directly translatable from the laboratory to an airborne operational situation. Criteria will be established relating eye movements to efficiency of visual performance, thereby permitting the development of a method of assessing a task in terms of expectation of its effect in producing efficient crew performance.

25. (U) Progress: N/A

*Available to contractors upon originator's approval

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	74 07 01	DD-DR&E (AR) 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
73 07 01	T. Proposed	U	U	N/A	NN	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				DDDD
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Physiological Assessment and Evaluation of Protective Crew Equipment Development Criteria

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) 016200 Stress Physiology; (U) 013300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
74 07	CONT.	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
PRECEDING FISCAL YEAR 74		
CURRENT FISCAL YEAR 75	1.7	154.0

19. RESPONSIBLE DOD ORGANIZATION

NAME:* Bureau of Medicine and Surgery
Washington, D.C. 20372

ADDRESS:*

RESPONSIBLE INDIVIDUAL

NAME: Brodine, C.E., CAPT, MC, USN (BUMED 71)

TELEPHONE: AREA Code—202—254-4361

21. GENERAL USE

C

20. PERFORMING ORGANIZATION

NAME:* NAVAL AIR DEVELOPMENT CENTER
CREW SYSTEMS DEPARTMENT

ADDRESS:* WARMINSTER, PA. 18974

PRINCIPAL INVESTIGATOR

NAME:* Rodgers, S. J., LCDR (403105)

TELEPHONE: 215-755-2717

ASSOCIATE INVESTIGATORS

NAME: Baas, W. D., LT (4032)

NAME:

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Medical Monitoring; (U) Medical Analysis

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objective. To assure that protective crew equipment, which is being developed and tested by the Department's engineering divisions (401 & 404) meets optimal physiological and biomedical criteria.

24. (U) Approach. Since physiological stress is a component collateral pathway in the research and development of protective crew systems it is imperative that biomedical expertise be included in these development efforts at the earliest stage possible, i.e., even before the first line is made on the drawing board. Thus, this cooperative effort will contribute significantly to the improvement of protective systems as well as be cost reductive, because design approaches which are incompatible with the present state of the art biomedical criteria, would be disregarded before man years and material have been spent unnecessarily. These efforts will include, but not necessarily be restricted to, escape systems and their testing on the ejection seat tower; G protective systems and their testing on the human centrifuge; impact mitigating systems and their testing on the horizontal accelerator and drop tower; and environmental protective systems and their testing in pan-climatic chambers. In addition, this work unit will assume the responsibility for the safety of experiments using human volunteers including the medical monitoring of actual tests.

5. (U) Progress. A new work unit.

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	74 07 01	DD-DR&E (AR) 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
N/A	T. Proposed	U	U	N/A	NN	☐ YES ☐ NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				BBBB
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Physiological Effects of Stressful Environmental Conditions on Naval Aircrewmen Using an Automatic Liquid Conditioning System

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

(U) 013300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
Jul 74	Jun 77	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 74	0	0
FISCAL YEAR CURRENT 75	0.3	32.0

19. RESPONSIBLE DOD ORGANIZATION

NAME:* Bureau of Medicine and Surgery
Washington, D.C. 20372

ADDRESS:*

RESPONSIBLE INDIVIDUAL

NAME: Brodine, C.E., CAPT, MC, USN (BUMED 71)

TELEPHONE: AREA Code—202— 254-4361

20. PERFORMING ORGANIZATION

NAME:* NAVAL AIR DEVELOPMENT CENTER
CREW SYSTEMS DEPARTMENT

ADDRESS:* WARMINSTER, PA. 18974

PRINCIPAL INVESTIGATOR

NAME:* SantaMaria, L.J. (403101)

TELEPHONE: 215-755-3228

ASSOCIATE INVESTIGATORS

NAME: Cooper, T.M., LT, MSC, USN (403103)

NAME: 215-755-3228

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Liquid Conditioning; (U) Fluidic Controllers

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Technical Objective. To determine the physiological effects of stressful environmental conditions on Naval aircrewmen using an automatic liquid conditioning system.

24. (U) Approach. Using a prototype system in which inlet water temperature is modulated in four major areas of the body surface in accordance with reference temperatures indicative of a state of thermal comfort, three subjects will be exposed to different sets of environmental conditions. The experimental plan will include the following independent variables, ambient temperature, humidity, air velocity and metabolic levels of heat production. The dependent variables of prime physiological interest will include body temperature, surface skin temperature, heart rate, respiration rate and weight loss. The aircrew protective suit assembly and exposure time (1 hour) will be maintained constant in all tests of the program. Each test using the identical set of environmental conditions will be replicated with each subject acting as his own control. According to present plans, the results of 95 individual trials are expected to produce an estimate of the effectiveness of the automatic liquid conditioning system in the maintenance of thermal confort among Naval aircrewmen.

25. (U) Progress. A new work unit.

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	750701	DD-DR&E (AR) 636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. New	U	U			☐ YES ☐ NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

Pressurized, Heated Medical Evacuation Bags (PHMEC)

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7508	7707	DN	C. In-House

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 75	-	-
	CURRENT 76	1.0	85.0

19. RESPONSIBLE DOD ORGANIZATION

NAME:* Naval Medical Research & Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: Brodine, C. E., CAPT (BUMED-71)

TELEPHONE: AREA Code–202–254-4361

20. PERFORMING ORGANIZATION

NAME:* NAVAL AIR DEVELOPMENT CENTER
Crew Systems Department

ADDRESS:* Warminster, PA. 18974

PRINCIPAL INVESTIGATOR

NAME:* Santa Maria, L. J. (403403)

TELEPHONE: Autovon 443-3228

ASSOCIATE INVESTIGATORS

NAME: R. Bell

NAME:

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Hypothermia; (U) Shock; (U) Medical Evacuation

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) The objectives of this study are: 1) to determine the feasibility of applying technological advances achieved in survival equipment for naval aircrewmen to a life-saving device designated as PHMEC (Pressurized and Heated Medical Evacuation Capsule), and 2) to demonstrate the efficacy of PHMEC in providing heat, lower body pressure, and body support for on-site and continuous treatment of casualties during evacuation. Successful realization of PHMEC will have both Triservice and civilian applicability resulting in more immediate and effective emergency medical care for casualties and accident victims.

24. (U) A feasibility study shall be made to combine a DAPS (Downed Aviator Power Source) and warm water circulating system (pump and tubing) with a pneumatic system (pump and bladders) to form a litter-borne capsule, PHMEC. If feasibility is shown, a prototype PHMEC will be constructed and its performance evaluated with regard to applying lower body pressure to counteract the hypovolemia of shock, heat to reverse hypothermia, and immobilization and body support to facilitate handling and evacuation. Objective measures of skin and core temperatures and applied pressure will be combined with subjective assessments to evaluate PHMEC performance.

25. N/A.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
777302	781001	DD-DDR&E (AR) 636 (3900)

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
771001	D. CHANGE	U	U	X	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	63706N	M0096PN	M0096PN001	3018
b. CONTRIBUTING	0	0	0	
c. CONTRIBUTING	0	0	0	

11. TITLE *(Precede with Security Classification Code)** (U) Physical Fitness and Tolerance to Stress in Fleet Studies of Illness, Accidents, and Performance

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 016200 Stress Physiology; 012400 Personnel Selection and Maintenance; 013400 Psychology; 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
7607	7909	DN	C. In-House

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR — PRECEDING FY 78	3.15	64
FISCAL YEAR — CURRENT FY 79	.30	11

19. RESPONSIBLE DOD ORGANIZATION 391584
NAME:* Naval Medical Research and Development Command
ADDRESS:* National Naval Medical Center Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL
NAME: J. D. BLOOM, CAPT MC USN
TELEPHONE: AREA Code—202—295-1543

20. PERFORMING ORGANIZATION 391642
NAME:* Stress Medicine Division Naval Health Research Center
ADDRESS:* San Diego, CA 92152

PRINCIPAL INVESTIGATOR
NAME:* HODGDON, J. A. LT MSC USNR
TELEPHONE: 714-225-4308

ASSOCIATE INVESTIGATORS
NAME: WARD, H.W. LCDR MC USNR
NAME: RAHE, R.H. CAPT MC USN

21. GENERAL USE
C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Human Subjects (U) CIVAPP: Physical Fitness; (U) Psychological Stress; (U) Illness; (U) Coping

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23.(U): Naval fleet populations, such as submariners and aviators, represent highly trained groups. Accident and physical or psychological illness in key personnel could disrupt the functioning of the entire unit. To assist in the goal of keeping as many men as possible in optimal health, we propose studies addressing the question of whether or not a relationship exists between the level of physical fitness and health (physical and psychological), job performance and the ability to cope with job stresses.

24.(U): Following selection of suitable populations of aviators and submariners, our basic experimental approach will be to measure physical fitness (both endurance, fitness, and strength) levels before and after a mission or deployment. Health, job performance and coping measures will be collected during the mission or deployment, and samples of men engaged in an additional physical exercise program will be compared with control samples which did not engage in the program.

25.(U): (21 Apr 77-30 Apr 78). Data including aerobic fitness ($\dot{V}O_2max$), weight, percent body fat, landing safety officer (LSO) scores, and number of sick-call visits were collected from 53 pilots aboard the USS JOHN F. KENNEDY (CV-67). A subsample of one-half the pilots were given a bicycle exercise program. Pilots reported their exercise, on and off the bike, during the cruise. For analysis, the pilots were divided into 4 groups: I- no reported exercise; II - only non-bicycle exercise; III - Only bicycle exercise; and IV - bicycle and other exercise. Significant ($p<0.05$) increases in $\dot{V}O_2max$ and daytime LSO scores, and significant decreases in weight and percent body fat were found for the sample as a whole. No significant correlations between $\Delta\dot{V}O_2$ and ΔLSO scores or number of reported illnesses were found; however, ANOVA of groups vs. time for each measure showed a significant group-time interaction for daytime LSO which bears further investigation. No publications from this work.

**Available to contractors upon originator's approval*

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1.AGENCY ACCESSION*	2.DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DN877463	781001	DD-DR&E (AR) 636 (3900)

3.DATE PREV SUM'RY	4.KIND OF SUMMARY	5.SUMMARY SCTY*	6.WORK SECURITY*	7.REGRADING*	8a.DISB'N INSTR'N	8b.SPECIFIC DATA-CONTRACTOR ACCESS	9.LEVEL OF SUM
771001	D. CHANGE	U	U	X	NL	X YES ☐ NO	A. WORK UNIT

10.NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62758N	ZF51.524	023	2009
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Comparison of the validity and cost-effectiveness of computerized individual and group audiometric systems

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

000200 Acoustics; 012400 Personnel Selection and Maintenance (Medical)

13.START DATE	14.ESTIMATED COMPLETION CATE	15.FUNDING AGENCY	16 PERFORMANCE METHOD
771001	7910	DN	C. In-House

17.CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18.RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING FY 78	.3	23
FISCAL YEAR CURRENT FY 79	.7	91

19.RESPONSIBLE DOD ORGANIZATION 391584

NAME:* Naval Medical Research and Development Command

ADDRESS:* National Naval Medical Center
Bethesda, Maryland 20014

RESPONSIBLE INDIVIDUAL

NAME: J. D. BLOOM, CAPT, MC, USN

TELEPHONE: AREA Code—202— 295-1453

20.PERFORMING ORGANIZATION 252220

NAME:* Auditory Research Division
Naval Submarine Medical Res. Lab.

ADDRESS: Naval Submarine Base New London
Groton, Connecticut 06340

PRINCIPAL INVESTIGATOR

NAME:* SMITH, P. F., M.A.

TELEPHONE: (203) 449-3201

ASSOCIATE INVESTIGATORS

NAME: HARRIS, J.D., Ph.D.

NAME:

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) CIVAPP; (U) Human Subjects; (U) Audiometry; (U) Control; (U) Automatic; (U) Group Dynamics; (U) Computer Applications; (U) Information Systems

23. TECHNICAL OBJECTIVE.* 24. APPROACH.* 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. TECHNICAL OBJECTIVE. (U) The objective of the proposed research is to develop a cost-effective group audiometric system of the highest validity for use in Navy hearing conservation programs. A variety of methods measure the hearing levels of individuals. Each has inherent advantages and disadvantages. Few have been adapted for efficient group testing. This work unit applies computer techniques to create the most efficient group testing system which will (1) accommodate large numbers of persons with minimal reliance on the intervention of audiometric technicians, (2) provide record-keeping and retrieval functions, (3) require the least time away from work for the tested persons, and (4) be uniform throughout the Navy.

24. APPROACH. (U) Eight separate testing methods are under investigation. A computer presents stimuli, records and evaluates responses, and stores data for interrogation. Each method is compared with standard manual clinical audiometry. Methods will be assessed for cost-effectiveness on uniformed personnel and on naval civilian employees in shipyards and shops.

25. PROGRESS. (U) A tape-driven apparatus was constructed consisting of logic circuits and programmable attenuators to deliver an audiometric program of one descending and one ascending series using the Fletcher pulse-tone method. Comparisons have been made on 36 subjects between this program and standard manual audiometry by qualified audiologists. Earphones have been found which are matched within 1 decibel through 8 kHz. Software for the PDP-11 computer has been created yielding audiograms on the standard manual pattern, with provision for assessing the effects of tone duration, response latency, number of threshold-crossings, etc. Software is being created to produce a variety of other patterns and to store local audiograms in a prototype central register.

**Available to contractors upon originator's approval*

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	19 Oct 78	

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	D. Change	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	NAMRL			207-088
b. CONTRIBUTING	61153N	RR 041-08	RR 041-08-02	
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)**

(U) Biomechanical Influences on Spinal Cord Function to Obtain Rationale

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 002400 Bioengineering for Protective Equipment; 012900 Physiology; 016200 Stress Physiology; 013300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY		16 PERFORMANCE METHOD
1 Sep 77	CONT.	DN	DN	B. Contract

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:* N00014-77-C-0749

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: EXT f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 78	0.6	32
	CURRENT 79	1.0	57

19. RESPONSIBLE DOD ORGANIZATION

NAME:*

ADDRESS:* OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
ARLINGTON, VIRGINIA 22217

RESPONSIBLE INDIVIDUAL

NAME: REID, D. H., CDR, MSC, USN 440B

TELEPHONE: AREA Code—202— 696-4057

20. PERFORMING ORGANIZATION

NAME:* Medical College of Wisconsin
Biomedical Engineering

ADDRESS:* 8700 West Wisconsin Avenue
Milwaukee, Wisconsin 53226

PRINCIPAL INVESTIGATOR

NAME:* Sances, A., Jr.

TELEPHONE: (414) 257-5508

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)*

(U) Spinal Cord Function; (U) Biomechanical Influences; (U) Conduction; (U)Evaluation

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) This investigation on the pathogenesis of traumatic spinal cord disease is to improve protective measures for naval aviators. The work is concerned with evaluating conduction in different portions of the spinal cord in monkeys subjected to various positions.

24. (U) Electrodes, chronically implanted over the sensory motor cortex of various areas of the spinal cord in monkeys, will be used to obtain base values for evoked potentials and threshold for cortically induced muscle contraction. The animals then will be fixed in a restraining device and the cervical spine stretched in extension, in neutral position and in flexion to evaluate transmission over nerve pathways. Periodic radiographs are taken to confirm the degree of curve and extent of spinal column lengthening. After being sacrificed, histological analysis of neuronal degeneration in the spinal cords will be made.

25. (U) Techniques were developed for evaluating efferent and afferent pathways of the spinal cord using the somatosensory evoked potential. Neurosurgical techniques were developed for chronic implantation of electrodes at the cervical medullary junction of the dorsal columns, thoracic level and lumbar level. Initial observations indicate substantial temporal changes in the early components of the somatosensory evoked potential, cervical medullary junction, medical lemniscus and cortex following 100g sled impacts. Experimental procedures were validated. Cusick, J. F., Myklebust, J. and Sances, A., Jr. "Evoked Potential Alterations in Spinal Cord Trauma: The Responsible Biomechanical Factors", Proc. 5th Int'l Symposium on Electrosleep and Electroanesthesia, Graz, Austria, 1978.

(Continued)

*Available to contractors upon originator's approval

NR 207-088
19 Oct 78
Code 444

(U) Biomechanical Influences on Spinal Cord Function to Obtain Rationale

Current evidence indicates that pathological stretch of the spinal cord is a major factor in the pathogenesis of a traumatic myelopathy. This myelopathy whether permanent or transient may occur without radiographic evidence of fracture or dislocation. As the spine becomes fully flexed, the cord is lengthened to its maximal physiological extent and further lengthening may be pathological. Research under this Work Unit proposes an objective and quantitative means for evaluating conduction in the anterior, lateral and posterior portions of the spinal cord in anesthetized monkeys. It involves the recording of specific and non-specific somatosensory evoked potentials and the determination of threshold for cortically induced muscle contractions.

REPORT BIBLIOGRAPHY:

Cusick, J. F., Myklebust, J., and Sances, A., Jr., "Evoked Potential Alterations in Spinal Cord Trauma: The Responsible Biomechanical Factors", Proc. 5th Int'l Symposium on Electrosleep and Electroanesthesia, Graz, Austria, September 11-16, 1978.

All contract requirements for technical and status reports have been met to date.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	4 Oct 77	

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61153N	RR 041-08	RR 041-08-02	207-113
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) NAVY ENVIRONMENT: Symposium on Biomedical and Bioengineering Analysis of Head, Neck and Central Nervous System Injuries

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

005100 Documentation and Information Technology; 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
	CONT.		B. Contract

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:*

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: NEW f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 77	0	0
	CURRENT 78	.3	15

19. RESPONSIBLE DOD ORGANIZATION

NAME:*

ADDRESS:* OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
ARLINGTON, VIRGINIA 22217

RESPONSIBLE INDIVIDUAL NAME: CALLAHAN, A. B., Dr. 444

TELEPHONE: AREA Code—202—692-4058

20. PERFORMING ORGANIZATION

NAME:* Medical College of Wisconsin

ADDRESS:* 561 North 15th Street
Milwaukee, Wisconsin 53233

PRINCIPAL INVESTIGATOR

NAME:* Sances, Anthony, Jr.

TELEPHONE: (414) 257-8227

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Navy Environment; (U) Conference; (U) Bioengineering (U) Head-Neck Injury; (U) Central Nervous System Injury

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) This conference on the biomedical and bioengineering analysis of head, neck and central nervous system injuries is intended to establish and to emphasize important areas of investigation critical to problems faced by the military in aircraft ejection and impact-acceleration injury. Particular attention will be paid to potential research productivity in biomedical and bioengineering areas with recommendations for future research.

24. (U) The format of this conference has been arranged for broad coverage of the bio-engineering and biomedical problems and research areas. The symposium and workshop will consider fundamental causes and mechanisms of rotational, translational and impact phenomena on the head, neck and central nervious systems, as well as, mathematical models of injury phenomena.

(continued)

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

444:ABC:tmc
NR 207-113
4 October 1977

MEMORANDUM

From: Code 444
To: Code 400
Via: Code 440

Subj: Support of a Symposium and Workshop on "Biomedical and Bioengineering Analysis of Head, Neck, and Central Nervous System Injuries"; information on

Ref: (a) ONRINST 4210.1F of 11 May 73

1. In accordance with reference (a), the following data is provided:

   a. Title of Conference: "Biomedical and Bioengineering Analysis of Head, Neck, and Central Nervous System Injuries"

   b. Security Classification: Unclassified

   c. Date: 30 November - 4 December 1977

   d. Location: Marco Beach, Florida

   e. Invitation List: Open invitation

   f. Individual to be Contacted: Mr. James L. Quinlan, Medical College of Wisconsin, 561 North 15th Street, Milwaukee, Wisconsin 53233. Telephone number (414) 257-8227.

   g. Purpose of Conference: The conference will examine the state of current knowledge regarding the effects of translational or rotational impact acceleration and whiplash upon the head, neck and central nervous system. The Symposium and Workshop will consider problems that require elucidation and will delineate those of greatest importance and develop recommendation criteria for required research of importance to the military.

   h. Nature of Support: $15,123 for travel and subsistence of 10 - 12 invited participants and miscellaneous costs in connection with the meeting.

(continued)

444:ABC:tmc
NR 207-113
4 October 1977

Subj: Support of a Symposium and Workshop on "Biomedical and Bio-engineering Analysis of Head, Neck, and Central Nervous System Injuries"; information on

i. Other Agencies Providing Support: None

j. Sponsoring Organization: Office of Naval Research

k. Expected Benefit to the Navy: The conference will establish and emphasize important areas of investigation critical to problems faced by the military in impact acceleration areas which include: aircraft seat ejection, parachute opening shock and impact injury prevention.

A. B. CALLAHAN

HE

NR 207-148
22 Feb 78
Code 444

(U) Navy Environment: Evaluation of Predictors of Motion Sickness Susceptibility and Physiological Correlation of Motion Stress

Comparative determination of how sick-making a particular vehicle or duty station may be are needed to improve the design of existing and future navy platforms. Measurement of this important aspect of mechanical performance is hindered by individual differences in susceptibility to motion sickness. Ideally, test groups of volunteers for study of the effects of simulated sea states and the like would be composed of persons who were, on the average, equally susceptible. The selection of such individuals would be possible if a reliable, standardized quantative measure of motion-sickness proneness existed. This research seeks to establish such capability.

REPORT BIBLIOGRAPHY:

THis is a new Work Unit.

(continued)

DD-1498 Unavailable 11/24/78 DHR

HE

A Proposal for the Evaluation of Prediction of Motion Sickness Susceptibility and Physiological Correlation of Motion Stress

D. J. Thomas, M.D.
and
J. C. Guignord, MB, ChB

26 January 1978

MOTION SICKNESS PREDICTION

Heave, roll and pitch motions predicted from a model of an advanced surface platform have been used for extensive human research. The purpose of the research was to determine the effects, if any, on a variety of tasks analogous to anticipated ship board occupations. The simulations of three different sea states extended for various periods of time up to 48 hours. The overriding human effect was nausea and vomiting due to motion sickness (1). This caused severe deficits in motivation resulting in task abandonment despite major volitional effort to overcome the ravages of motion sickness. As a result very little decrement of performance was noted in the tests performed. However, there was extensive loss of performance because volunteers were disabled by motion sickness or aborted their runs and were unavailable to perform.

A major conclusion consistent with prior reports of motion sickness incidence and experiments is that there is a wide range of variability in individual susceptibility to motion sickness. Fifteen volunteers were ranked in accordance with susceptibility as determined by elapsed time and motion severity of which vomiting first occurred. A further attempt was made to correlate this ranking with an index of motion sickness susceptibility based on the results of VVI, BVDI and PATE tests conducted on the volunteers of NAMRL, Pensacola, Florida. However, this index was arbitrarily selected. It is proposed to review the test scores in order to determine the most sensitive predictor of heave motion sickness susceptibility in the data base. Such an effort can at best generate a hypothesis for further testing at NAMRLD when the ship motion device is operable.

The results from physiological optics and vestibular physiology testing will be reviewed and ranked. The ranking will be correlated with the rank order of resistance to the phase II motions. A further effort will be made to quantitate the observed resistance to motion by a time to emesis and motion severity index. If such a scale can be constructed, a much more precise parametric model of motion sickness prediction can be postulated.

(continued)

Another major finding of the 2000T SLS simulation was that volunteers once they began to vomit and continued to do so until they completed the run or until they aborted. This led to considerable motion stress particularly evident in one case where a volunteer vomited ten times over a 23 hour period. After a machine shut down, he decided not to continue. He suffered from severe hemoconcentration with hemoglobin of 16.3% and urine concentration with specific gravity of 1.037 at the completion of the run.

It would be desirable to have a rapid and readily available means of assessing the degree physiological stress once motion sickness has begun. This will be attempted by review of the urine volume and specific gravity determination of volunteers after motion sickness as evident by vomiting had occurred. Previous experiments with volunteers using a rotating platform and head motion have shown a correlation between decreased urine flow, increased specific gravity and chloride in association with motion sickness (2). An attempt will be undertaken to investigate this effect from results in Phase II.

MOTION AND MIXED SINUSOIDAL FREQUENCIES

In a correlation study undertaken after Phase II, concerning motion sickness incidence in various harmonic motion conditions (3), a number of tests of the volunteers' subjective and postural response to motion were performed experimentally as past of the search for predictive methods in motion sickness studies. It is intended to carry out further analyses of the data gathered from these tests.

Estimated budget: $18,000 for salaries

1. Thomas, D. J., Majawski, P. L., Guignard, J. C. & Ewing, C. L. Clinical medical effects on volunteers undergoing 48 hour motion simulations of the 2000 ton surface effect ship model. Naval Aerospace Medical Research Laboratory Detatchment, New Orleans, LA, 7 April 1976.

2. Taylor, N. B. G., Hunter, J. & Johnson, W. H. Antiuresis as a measurement of laboratory induced motion sickness. Canadian Journal of Biochemistry and Physiology, Vol. 35, 1957, 1017-1027.

3. Guignard, J. C. & McCauley, M. E. Motion sickness incidence induced by complex periodic waveforms. Final report to ONR, December 1976. (Revised May 1977)

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	21 Sep 78	

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61153N	RR 041-08	RR 041-08-02	207-114
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Navy Environment: Dynamic Response of Human Head and Neck to Impact Acceleration

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

002400 Bioengineering; 012900 Physiology; 013300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
Oct 77	CONT.	DN	B. Contract

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:* N00014-78-C-0121

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: EXT f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 78	3.1	183
	CURRENT 79	1.6	98

19. RESPONSIBLE DOD ORGANIZATION

NAME:*

ADDRESS:* OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
ARLINGTON, VIRGINIA 22217

RESPONSIBLE INDIVIDUAL

NAME: Callahan, A. B., Dr. 444

TELEPHONE: AREA Code–202– 696-4058

20. PERFORMING ORGANIZATION

NAME:* QEI, Incorporated

ADDRESS:* 119 The Great Road
Bedford, Massachusetts 01730

PRINCIPAL INVESTIGATOR

NAME:* Thorpe, R.

TELEPHONE: (617) 275-6800

ASSOCIATE INVESTIGATORS

NAME:

NAME:

21. GENERAL USE C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Navy Environment; (U) Air Crew Survival; (U) Head and Neck Dynamics; (U) Impact Injury Modeling; (U) Head Acceleration

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) The design of safety devices for pilots of fixed wing and rotary wing aircraft is dependent on our understanding of the response of the human body to extreme acceleration and impact forces. This research will assist in establishing this dynamic response of the human body to acceleration and impact forces.

24. (U) The principal investigator will reduce and analyze the large amount of data on 3-D head-neck and torso response to impact acceleration that is being collected at the Naval Aerospace Medical Research Laboratory, Detachment, New Orleans. Inertial sensor data, physiological data and sled data will be digitized and normalized to standard conditions and analysis performed on this data for application in dynamic response models. The principal investigator will also participate in experimental protocol planning and formation to provide analytical rationale for experimental procedures.

25. (U) Automated techniques which combine photographic data with sensor data have been initiated to establish initial conditions for the impact event. These methods integrate and/or differentiate the sensor data to get all linear and angular accelerations, velocities and displacements. Procedures have also been established to perform signal analysis on raw data for removing distortion and noise. In addition, techniques have been designed to transform collected impact data into appropriate coordinate systems.

(continued)

*Available to contractors upon originator's approval

NR 207-114
21 Sep 78
Code 444

(U) Navy Environment: Dynamic Response of Human Head and Neck to Impact Acceleration

The design of safety devices for pilots of fixed wing and rotary wing aircraft is dependent on our understanding of the human body response to extreme acceleration and impact forces. Such safety devices include: head restraints, body harness, helmets and cockpit design. This effort will provide information on the dynamic response of the human head, neck and torso to various acceleration profiles.

This research effort will be performed in conjunction with the Naval Aerospace Medical Research Laboratory, Detachment, (NAMRL/D), New Orleans, NAMRL/D will perform the experiments on dynamic response of human subjects to impact acceleration forces in various vector directions. QEI will format, design analytical techniques, reduce and analyze this data and provide the results to NAMRL/D. QEI will also participate in experimental protocol planning in order to provide analytical rationale for experimental data collection techniques. Further the principal investigator will cooperate with other contractors involved in this program to validate existing dynamic response models currently being used for engineering design.

This research effort is part of and coordinated with the Tri-Service Impact-Acceleration Injury Prevention Program.

REPORT BIBLIOGRAPHY:

All contract requirements for technical and status reports have been met to date.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	18 May 78	

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
	A. New	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61153N	RR 041-08	RR 041-08-02	207-152
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) NAVY ENVIRONMENT: Neuropathology of Central Nervous System Following Impact Injury

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 002400 Bioengineering; 005900 Environmental Biology; 006000 Escape, Rescue and Survival; 008800 Life Support

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
	CONT.	DN	B. Contract

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: NEW f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING		
	CURRENT 78	.17	9.7

19. RESPONSIBLE DOD ORGANIZATION
NAME:*
ADDRESS:* OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
ARLINGTON, VIRGINIA 22217
RESPONSIBLE INDIVIDUAL
NAME:
TELEPHONE:

20. PERFORMING ORGANIZATION
NAME:* Rehabilitationsklinik Loipl
D-8242
ADDRESS:* Bischofswiesen/Berchtesgaden
Germany
PRINCIPAL INVESTIGATOR
NAME:* Unterharnscheidt, F. J., Dr.
TELEPHONE: 49-08652-7494
ASSOCIATE INVESTIGATORS
NAME:
NAME:

21. GENERAL USE C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Navy Environment; (U) Impact Injury; (U) Neuropathology (U) Biodynamics

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) The Naval Aerospace Medical Research Laboratory Detachment, New Orleans (NAMRL/DET) is conducting experiments to determine human dynamic response to impact acceleration as part of an Aircraft Impact Injury Prevention Program. This Work Unit is concerned with a study of the effects of impact-acceleration on the nervous system.

24. (U) This research will be performed in conjunction with the U. S. Navy research effort. Experimental procedures will be performed at NAMRL/D. Neuropathological tissue will be sent to the Rehabilitationsklinik Loipl. The contractor will be responsible for the preparation of micro and macropathological examination of these specimens.

(continued)

**Available to contractors upon originator's approval*

NR 207-152
18 May 1978
Code 444

(U) Navy Environment: Neuropathology of Central Nervous System Following Impact Injury

At the Naval Aerospace Medical Research Laboratory Detachment in New Orleans, experiments are conducted to determine the dynamic response to impact acceleration. It is necessary to extrapolate the effects of impact on humans with respect to the damage to the central nervous system from experiments with non-human primates. Selection, preparation and examination of the damaged tissues from the monkey for this purpose calls for special expertise available through Dr. Unterharnscheidt, who has also the necessary rapport with the staff at the Naval Aerospace Medical Research Laboratory Detachment.

REPORT BIBLIOGRAPHY:

This is a proposed new Work Unit.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	2 Nov 78	

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
13 Sep 77	D. Change	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61153N	RR 041-08	RR 041-08-02	NR 207-037
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) Navy Environment: Establishment of a Mathematical Model for Prediction of Human Dynamic Response to Impact Acceleration

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 006000 Escape, Rescue and Survival; 013300 Protective Equipment; 012900 Physiology; 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
1 Dec 73	CONT.	DN	B. Contract

17. CONTRACT/GRANT
a. DATES/ EFFECTIVE: EXPIRATION:
b. NUMBER:* N00014-74-C-0154
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: EXT f.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR PRECEDING 78	.6	36
FISCAL YEAR CURRENT 79	.6	37

19. RESPONSIBLE DOD ORGANIZATION
NAME:*
ADDRESS:* OFFICE OF NAVAL RESEARCH
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RESPONSIBLE INDIVIDUAL
NAME: Callahan, A. B., Dr. 444
TELEPHONE: AREA Code—202— 696-4058

20. PERFORMING ORGANIZATION
NAME:* Dennis E. Smith
785 Cornwall Road
ADDRESS:* State College, Pennsylvania 16801

PRINCIPAL INVESTIGATOR
NAME:* Smith, D.E.
TELEPHONE: (814) 238-3771

ASSOCIATE INVESTIGATORS
NAME:
NAME:

21. GENERAL USE C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Navy Environment; (U) Injury Prediction; (U) Impact Acceleration; (U) Mathematical Model; (U) Human Dynamic Response

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Present knowledge of the human dynamic response to impact acceleration is not sufficiently adequate to provide a precise physiological basis for design and test criteria for life support or survival equipment, or tolerance levels of impact forces. Establishment of this information will permit incorporation of the physiological capability of the user into the design and test procedures of operational safety and survival equipment of military personnel exposed to high accelerative force environments.
24. (U) The proposed effort has as its primary goal the investigation of mathematical methods and techniques required for the establishment of a predictive mathematical model for the probability of injury in impact acceleration environments. The investigator is defining the required numerical measures of dynamic response, evaluating candidate dynamic response predictive models and candidate injury prediction models. Selected models will be evaluated with dynamic response data collected by the U. S. Navy.
25. (U) This research effort has produced significant results in two main areas: (1) a head/neck dynamic response model predicts the time-varying inertial response of the unrestrained human head to G_x acceleration and (2) an impact acceleration injury prediction model to predict the probability of a head/neck injury. In addition, over the past year, three different motion sickness incidence (MSI) models were evaluated; independent effects model, weighting model and least squares weighting. None of these models has proved satisfactory for prediction of motion sickness to broad band motion.
Smith, D.E. and Anderson, W. R., "Predictive Model of Dynamic Response of the Human Head/Neck System to G_x Impact Acceleration", Aviation, Space and Environmental Medicine, January, 1978.

(continued)

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

NR 207-037
2 Nov 78
Code 444

(U) Navy Environment; Establishment of a Mathematical Model for Prediction of Human Dynamic Response to Impact Acceleration.

This Work Unit has had continued productivity in the two major areas for which it was initiated: i.e., the development of a predictive model of human head/neck system dynamic response to $-G_x$ impact acceleration and a predictive model for impact injury. This Work Unit is also concerned with the dynamic response of crew personnel to ship motion. All of these efforts are performed in cooperation with the Naval Aerospace Medical Research Laboratory, Detachment, New Orleans.

REPORT BIBLIOGRAPHY:

Smith, D.E. and Anderson, W. R., "Predictive Model of Dynamic Response of the Human Head/Neck System to $-G_x$ Impact Acceleration", Aviation, Space, and Environmental Medicine, January 1978.

Smith, D.E. and Gardner, R. L., " A Study of Estimation Accuracy When Using a Logistic Model for Prediction of Impact Acceleration Injury", Technical Report No. 102-5, Desmatics, Inc., 1978.

Smith, D. E., "An Examination of Statistical Impact Acceleration Injury Prediction Models Based on $-G_x$ Accelerator Data for Subhuman Primates", Technical Report No. 102-6, Desmatics, Inc., 1978.

All contract requirements for technical and status reports have been met to date.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION *	2. DATE OF SUMMARY * 28 Jul 77			REPORT CONTROL SYMBOL
3. DATE PREV SUM'RY 77	4. KIND OF SUMMARY D. Change	5. SUMMARY SCTY * U	6. WORK SECURITY * U	7. REGRADING * NA	8a. DISB'N INSTR'N NL	8b. SPECIFIC DATA-CONTRACTOR ACCESS ☒ YES ☐ NO		9. LEVEL OF SUM A. WORK UNIT
10. NO./CODES: *	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER		
a. PRIMARY	63706N	M0097		M0097.001		NR 207-011		
b. CONTRIBUTING	61153N	RR 041-08		RR 041-08-02				
c. CONTRIBUTING								

11. TITLE *(Precede with Security Classification Code)** (U) NAVY ENVIRONMENT: Analysis of Electrophysiological Signals from Animals Subjected to Biodynamic Stress

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

002400 Bioengineering; 012900 Physiology; 013300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY			16 PERFORMANCE METHOD
Mar 76	CONT.	DN	DN		B. Contract

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER: * N00014-76-C-0911

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: EXT f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 76	.05	3
	CURRENT 77	.08	5

19. RESPONSIBLE DOD ORGANIZATION

NAME: *

ADDRESS: * OFFICE OF NAVAL RESEARCH
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RESPONSIBLE INDIVIDUAL NAME: CALLAHAN, A. B., Dr. 444

TELEPHONE: AREA Code—202— 692-4058

21. GENERAL USE

C

20. PERFORMING ORGANIZATION

NAME: * Texas Research Institute of Mental Sciences

ADDRESS: * 1300 Moursund Avenue, Tex. Med. Ctr.
Houston, Texas 77025

PRINCIPAL INVESTIGATOR

NAME: * Saltzberg, B.

TELEPHONE: (713) 797-1976

ASSOCIATE INVESTIGATORS

NAME:

NAME:

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Navy Environment; (U) Impact Acceleration; (U) Neurophysiological Response; (U) EEG; (U) Evoked Potentials; (U) Data Analysis

23. TECHNICAL OBJECTIVE. * 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) This Work Unit is to assist in analysis of electroencephalogram (EEG) and evoked potential data obtained from impact acceleration experiments conducted at the Naval Aerospace Medical Research Laboratory. The objective is to characterize the neurophysiological response of non-human primares to various stimuli of biodynamic stress.

24. (U) THe analysis of EEG and evoked potential data due to median nerve stimulation of Rhesus monkeys undergoing impact acceleration will be carried out by special purpose time series computation equipment. The effort includes study of EEG background data, acquired prior to median nerve stimulation, by means of power spectral density analysis. The statistical characteristics of latency and amplitude parameters obtained from the average evoked potentials (AEP) will be examined and the properties of these AEP parameters will be correlated with the biodynamic profile in order to determine the neurophysiological response to stimulation.

25. (U) Signal analysis procedures appropriate to investigation of EEG and evoked potential data on experimental animals subjected to impact acceleration have been performed. Statistical evaluations of the results are now being conducted.

(continued)

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITION OF THIS FORM IS OBSOLETE

NR 207-011
28 Jul 77
Code 444

(U) NAVY ENVIRONMENT: Analysis of Electrophysiological Signals from Animals Subjected to Biodynamic Stress

This Work Unit in support of studies carried out at the Naval Aerospace Medical Research Laboratory (NAMRL), Detachment at Michoud Station, New Orleans, continues to provide fruitful assessment of data on the neurophysiological effects of biodynamic stress. In the conduct of experiments at NAMRL drugs are used to prepare experimental animals for biodynamic testing. Thus, it is essential in the evaluation of the test data to separate effects of these drugs from neurophysiological effects due to biodynamic causes. During the coming year, emphasis will be drug effects from biodynamic consequences.

REPORT BIBLIOGRAPHY:

All contract requirements for technical and status reports have been met to date.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	9 March 78	

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
Jun 77	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES.*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	61153N	RR041-08	RR041-08-02	NR 207-054
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE *(Precede with Security Classification Code)** (U) NAVY ENVIRONMENT: Determination of Physical Data of the Head and Neck Material

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

002400 Bioengineering; 013300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION CATE	15. FUNDING AGENCY	16 PERFORMANCE METHOD
Feb 75	CONT.	DN	B. Contract

17. CONTRACT/GRANT

a. DATES/ EFFECTIVE: EXPIRATION:

b. NUMBER:* N00014-75-C-0486

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS *(In thousands)*
FISCAL YEAR	PRECEDING 77	.1	6
	CURRENT 78	.2	11

19. RESPONSIBLE DOD ORGANIZATION

NAME:*

ADDRESS:* OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
ARLINGTON, VIRGINIA 22217

RESPONSIBLE INDIVIDUAL

NAME: CALLAHAN, A. B., Dr. 444

TELEPHONE: AREA Code—202—692-4058

20. PERFORMING ORGANIZATION

NAME:* University of Munich
Institute of Forensic Medicine

ADDRESS:* Munich, Germany

PRINCIPAL INVESTIGATOR

NAME:* Spann, W., Dr.

TELEPHONE:

ASSOCIATE INVESTIGATORS

NAME: Beier, G., Dr.

NAME: Ewing, C. L., CAPT, MC, USN (Ret.)

21. GENERAL USE

C

22. KEYWORDS *(Precede EACH with Security Classification Code)* (U) Navy Environment; (U) Anthropometry; (U) Impact Injury; (U) Cadaver; (U) Dynamic Response; (U) Acceleration

23. TECHNICAL OBJECTIVE.* 24. APPROACH. 25. PROGRESS *(Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)*

23. (U) Impact trauma represents a major caouse of death for military personnel in ground, sea and aircraft accidents. Basic information is needed on the dynamic response of subjects exposed to high levels of impact acceleration to provide a sound rationale for the development of improved restraint devices and safety equipment.

24. (U) Previous work on head and neck physical parameters has dealt with preserved cadaveric material. This effort provides an opportunity to examine fresh human cadaveric heads for more precise scaling to anatomical and physical characteristics of living human subjects.

25. (U) Measurements on the center of gravity and mass distribution in the x-z plane have been completed on 20 fresh specimens. Preliminary data reduction has been completed and final results are being prepared in report form. Spann, W. and Beier, G., "Determination of Physical Data of the Head," Status Report No. 2, 1976.

(continued)

*Available to contractors upon originator's approval

Code 444
NR 207-054
9 Mar 78

(U) NAVY ENVIRONMENT: Determination of Center of Mass and Center of Gravity of the Human Head-Neck System

Acceleration levels to be studied in the Navy's Impact Injury Prevention Program range beyond those suitable for application to living human subjects. Over the past two years, two dimensional (x-z planes) data on the center of gravity and center of mass of the human head and neck system has been obtained. Current research effort will extend this data to three dimensions (x-y-z planes). The data is to be transferred to the Naval Aerospace Medical Research Laboratory Detachment, Michoud Station, New Orleans.

REPORT BIBLIOGRAPHY

Spann, W. and Beier, G., "Determination of Physical Data of the Head," Status Report No. 2, 1976.

All contract requirements for technical and status reports have been met to date.

(continued)

444:ABC:gab
NR 207-054
9 March 78

MEMORANDUM FOR THE CHIEF OF NAVAL RESEARCH

Subj: Approval of Foreign Research and Development Project

Ref: (a) ASPR 6-805.2 of 1 Jan 69
(b) DDR&E Memorandum for ASN (R&D) of 15 Jul 68
(c) SECNAVINST 3930.3 of 25 Oct 68

Encl: (1) Code 444, PR, NR 207-054, University of Munich, Germany, and corresponding DD 1498 entitled "Determination of Physical Data of Human Cadaveric Head-Neck Assemblies"

1. Pursuant to the provisions of references (a), (b) and (c), enclosure (1) has been reviewed in the light of the established criteria.

2. The proposed foreign research and development project: (a) is significant in meeting defense needs for developing measures to prevent loss of life in Navy personnel involved in vehicle impact, (b) cannot be deferred for later action because the data is essential to the Navy's "Impact Injury Program under ADO 43-12X, Aircrew Impact Injury Prevention", (c) cannot receive financial support from non-United States sources and (d) offers the availability of a distinguished forensic pathologist and also a physicist working together, along with the availability of fresh cadaveric material. Extended exploration within the United States has revealed only two known sources of fresh cadaveric material, i.e., the University of Oklahoma and the University of Michigan. These were contacted and extensive scientific discussions ensued, but neither university was able to support the studies proposed. The University of Munich is the sole available source in either Europe or the United States.

ASSISTANT CHIEF FOR RESEARCH

From: Code 100
To: Code 600

1. In accordance with the authorization set forth in reference (b), the research project covered by enclosure (1) is approved.

CHIEF OF NAVAL RESEARCH

Appendix I

Research Summaries

Index of
Program Management Summary of Research
and Development Efforts

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Environmental Systems/Advanced ECS/ROVAC
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: J. McNamara/E. Boscola
Contributing Laboratory/Center: AFFDL/Wright-Patterson AFB
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide an improved, easily maintainable, low-cost, high-capacity aircraft environmental cooling systems (ECS) to meet expanding demand with a major aircraft weight reduction potential and a stable temperature and pressure characteristics for improving crew environment and avionics reliability.

b. Approach: Develop a closed-loop ECS having a positive-displacement air-cycle machine (ROVAC) and using fuel as the primary heat sink. Integrate with self-start system and advanced flight control systems.

c. Goals: Reduce gross aircraft weight penalty by 4000# in a typical 62,000# GTOW aircraft. Increase aircraft thrust by 2% and reduce fire hazard via recirculation takeoff. Increase cooling capacity by one-third. Increase reliability of cooling system and avionics systems. Reduce engine bleed air consumption by 85-95%. Eliminate ram-air intake drag.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Current ECS open-loop systems consume too much engine bleed air. Bleed air supply consumes power and is a fire hazard, as well as being subject to engine operating transients, thus causing cooling system temperature and pressure/volume output transients. Bleed air systems have a high weight/output ratio and their high temperatures require costly materials. The use of ram air for cooling adds to aircraft drag.

b. Payoff: A reduction of the weight penalty imposed by present systems of 25-50%. Extra cooling capacity (1/3) for avionics systems growth. Reduction of avionics maintenance work.

c. Risk: Introduction of the closed-loop system necessarily involves some technological risks. The low-speed character of the Advanced ECS/ROVAC is expected to moderate the R&M problems.

d. Applicable STO's: AW 8-A-8; SL 12-A-3, 12-G-14. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Navy supporting AF effort in the Advanced ECS program (AFFDL, WPAFB). AFFDL, WPAFB is lead laboratory in this 6.2 development effort.

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PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Environmental Systems/Sustained G-Protection
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R Crosbie (215) 441-2189
Project Engineer: E. Boscola/T. Zenobi
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description — a. Objective — b. Technical Approach — c. Goals

a. Objective: To increase aircrew G-tolerance to match peak and sustained aircraft G-force capability. To boost pilot performance for ACME missile evasion.

b. Approach: Utilize available and emerging technology (new anti-g valves, knee lift, body inclination, new technology controls/displays) for identifying ideal cockpit configuration as well as for identifying tradeoffs modification of cockpit systems in existing aircraft.

c. Goals: Improvement of task performance and moderation of straining and fatigue during exposure to 8G+ sustained up to 45 seconds in simulations representing prolonged and repeated ACM encounters and missile evasion tactics.

2. Justification — a. Problem — b. Payoff — c. Risk

a. Problem: Aircrew performance during exposure to high acceleration is degraded by failure of vision and cognitive processes caused by inability of circulatory system to supply oxygen to the brain. High G-forces inhibit pilot's ability to operate controls and overwhelming fatigue is hastened by muscular straining. The probability of loss of combat effectiveness, followed by loss of aircraft and crew, is gravely augmented.

b. Payoff: Increased mission effectiveness against ground and air targets and in combat survivability of aircraft and crew.

c. Risk: Retrofit of existing cockpits may be costly, particularly if it becomes necessary to reconfigure instrument panels for leg clearance. Retrofit plans for one aircraft may not be adaptable to another.

d. Applicable STO's: PN 11-B-18; TW 9-8-6, 9-C-2. Critical.

3. Program Coordination — Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Navy invited to attend technical meetings on USAF High Acceleration Cockpit program. Preliminary meetings. Navy assisting USAF HAC development with data runs & centrifuge improvement program to prepare for USAF prototype tests in FY-79.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Environmental Systems/Praeseodymium-Cerium Oxide OBOGS
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: R. J. Crosbie
Project Engineer: R. Routzahn/E. Boscola
Contributing Laboratory/Center: ASO Life Support SPO/Wright-Patterson AFB
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To eliminate hazardous and logistically burdensome LOX installations on ships and temporary forward bases by generating breathing oxygen aboard aircraft.

b. Approach: Conduct laboratory T&E on an open loop on-board oxygen generator using Praeseodymium-Cerium Oxides.

c. Goals: To determine the operational potential for aircraft use of a prototype unit previously developed under a joint program with the Air Force Flight Dynamics Laboratory.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Logistics, maintenance problems and safety hazards associated with LOX supply systems are severe and are a continuing threat to the effectiveness of aircraft carriers and their aircraft and of aircraft operating from remote bases.

b. Payoff: Enablement of fixed wing aircraft operations from small ships and temporary bases, a particular prerequisite for V/STOL, and major reduction of personnel demands in support of other VF/VA aircraft. Elimination of 30 ton/2300 ft.^{2} support requirement. Annual cost savings of $45M. Elimination of 20 x-installation fire hazard and casualty vulnerability.

c. Risk: Weight/size of A/C installed system and demands on aircraft resources.

d. Applicable STO's: AW 8-A-8; SL 12-A-3. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Initial development performed under contract with Union Carbide and the AFFDL, WPAFB. Current efforts are coordinated with the ASD Life Support SPO, WPAFB.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability Personnel Protection
Sub-Task Title: Environmental Systems/Partial Pressure Oxygen Sensor
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: R. Crosbie
Project Engineer: E. Boscola
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To develop an improved and miniaturized partial pressure oxygen sensing device for determining the partial pressure of the breathing oxygen delivered to Navy crewmen by on-board oxygen generating systems.

b. Approach: Investigate partial pressure oxygen sensor alternatives. Initiate development of desired approach and integrate with on-board oxygen generating systems.

c. Goals: To ensure crew safety by providing an oxygen pressure sensor which will reliably detect a drop in oxygen pressure in sufficient time to enable the crew to take preventative action.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Safety center statistics indicate that aircraft accidents have occurred when pilots have unknowingly lost the necessary oxygen pressure in their breathing system to sustain consciousness. Until forthcoming on-board oyxgen generating systems have reached a state of high reliability during aircraft operations, these statistics are likely to continue.

b. Payoff: To prevent aircraft accidents caused by insufficient oxygen pressure supplied to the pilot by alerting him when the oxygen partial pressure is reduced to an unsafe level.

c. Risk: The risk involved is in the miniaturation of current state-of-the-art systems for aircraft use and is considered to be moderate.

d. Applicable STO's: SL 12-A-3; 12-G-14. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☒ Other

USAF will be advised on progress of program through published reports and tri-service coordination meetings.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/400-600 KT. Protection
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: C. Woodward/M. Schwartz
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: High-Q ejection protection (400-600 knots)

b. Approach: Investigate the requirements for High-Q ejection escape. Define aerodynamic and deceleration forces developed on the man/seat/recovery system and their effects upon the escape and survivability of the aviator. Develop equipment for maximizing High-Q survivability without impairment of low-speed escape performance.

c. Goals: Goal reduction by 60% of High-Q fatalities and injuries.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Exposure to High-Q ejection has been increasing in frequency and severity; the resultant high-fatality incidence has degraded overall survivability rates over the last decade (only 37% of High-Q ejectees survived in CY-75). Many survivors are lost to aviation because of severe injuries.

b. Payoff: Reduction of aircrew replacement cost of $1.5 M per aviator fatality. Proportionate reduction of hospitalization and replacement costs of disabled avaiators. Improved aviator morale.

c. Risk: The risk for this effort is considered to be moderate.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☒ USMC ☒ Army ☐ USAF ☒ TriService ☐ Other

Information is disemminated through the NADC-Marine Liaison officer and through issuance of reports to: Cognizant Marine and Air Force Agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/Moldable Composite Seat
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: C. Woodward, W. Ward
Contributing Laboratory/Center: NPTR, El Centro
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To determine feasibility of utilizing the newly available moldable composite structures for basic ejection seat design and fabrication.

b. Approach: Investigate, in a trade-off study, factors of cost, strength, weight reliability maintainability and manufacturing complexity in comparison with existing seat designs. Build prototype seat for feasibility test and evaluation.

c. Goals: Reduction of cost and manufacturing complexity of ejection seats, improvement of subsystems design, reduction of maintenance effort, reduction in weight, and extension of service life.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Present basic ejection seat construction materials of aluminum, steel and honeycomb are costly to manufacture and maintain in the fleet, are prone to corrosion and component failures, have limited service life and are often excessively heavy and complex.

b. Payoff: New materials are available that will, if feasible for substitution, reduce initial costs, provide a lighter seat of comparable strength, extend the life cycle, lower fleet maintenance requirements by an estimated 80%, improve over-all component/system reliability.

c. Risks: The risk is considered moderate, with new material technology and manufacturing techniques being the pacing items.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other ____

The specification will be issued for triservice review and comment. Final report will be issued to all potential DOD users. USAF could benefit by incorporation into high-technology escape systems.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/ Microprocessor Control
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: C. Woodward / J. Tyburski
Contributing Laboratory/Center: NWC, China Lake
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To utilize a microprocessor as a control system for aircraft escapes systems.

b. Approach: Investigate the timing and sequencing aspects, reliability maintainability, size, weight, power requirements and environmental considerations.

c. Goals: To reduce maintainability to 5-year cycle checks, increase reliability of sequencing system to .9999, increase accuracy of timing to 1.0 millisecond, introduce variable multi mode timing and sequencing system and reduce weight and size.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Present ejection seat systems incorporate heavy ballistic timing and sequencing systems which require short interval periodic cartridge replacement. The accuracy of ballistic time delays at best can fluctuate 25%.

b. Payoff: A microprocessor control system will result in a lightweight, small, highly reliable and easily maintained sequencing system capable of interfacing with numerous survival subsystems.

c. Risks: The major risk would be the consequence of failing to fully utilize current technology to control precisely the intricate, multi-mode process required to maximize survivability in view of the long term (10 year) degradation of fatality rates for Naval aviators reported by the Naval Safety Center.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other ____
The USN is spearheading the technical application of microprocessors in escape system control. However, this technology is applicable to all services using ejection seat aircraft. Technology briefings of the microprocessor effort are disseminated to all services during annual triservice and other tech. coor. mtgs.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/Steering and Stabilization
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215)441-2189
Project Engineer: C. Woodward
Contributing Laboratory/Center: NWC, China Lake
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Develop improved methods of ejection seat stabilization, control and seat steering.

b. Approach: Develop and prove feasible a fluidic controlled, vernier seat-stabilizing rocket motor.

c. Goals: To improve ejection-seat trajectory and adverse attitude capability, thereby reducing the frequency of ejection injuries/fatalities.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Present escape systems are generally aerodynamically unstable and rely on antiquated and poorly effective design principles that often cause pilot-flailing injuries and equipment and subsystem failure. Present performance capability is limited, and escape systems fail to compensate for both high sink rate and adverse-attitude ejections.

b. Payoff: Improved aircrew recovery rate, particularly at adverse attitude and high sink rate conditions, based on vertical seeking and on redesign to overcome subsystem failures.

c. Risk: The risk for vertical seeking is considered moderate with the highest risk in the development of the vertical seeking sensor. The former risk of physiological incompatability appears to have been overcome by the extension of rocket burn time to 1-3/4 seconds. The risk for improved seat stabilization is considered minimal.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other ____

The Navy maintains close coordination and exchange of information with the Air Force on fluidic controlled seat stabilizing system; specifically the Air Force program on the fluidic controlled rotatable rocket motor nozzle and Navy programs on fluidic controlled vernier rocket and vertical seeking systems.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/Positioning and Restraint
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: C. Woodward/M. Schwartz
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Investigate requirements and develop and test ejection seat components and sub-systems which will assure optimum body position and restraint during normal and/or special aircraft accelerations and attitudes; and during ejection or crash.

b. Approach: Shoulder and Pelvic retraction and restraint systems inflatable retention means, integrated head support devices and anti-submarining restraints will be developed and tested for feasibility; and selection for advanced prototyping.

c. Goals: Reduce spinal injuries by 100%; reduce neck injuries by 100%; reduce submarining by 90%; reduce ejection on crewmen during ejection by 50%.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Pilots are being injured due to improper positioning and restraint prior to and during ejection. Injuries range from minor spinal trauma to fatal. Safe ejection requires proper spine alignments enforced by restraints.

b. Payoff: Successful completion of these projects will enable reduction of injuries/fatalities sustained by aircrewmen in the ejection of escape and during crash.

c. Risk: All development areas are within current or near term state-of-the-art and will impose little or no risk.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Information is disseminated through conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/Automatic Crewman Retraction
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2139
Project Engineer: C. Woodward/M. Schwartz
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide for manual actuation of a cyclicable inertia reel for positive aviator retention during periods of uncontrollable flight.

b. Approach: Design and develop a dual-purpose ballistic inertia reel to provide for both automatic torso restraint and retraction for ejection; and selectable inflight multiple retraction capability for temporary positioning during adverse flight conditions.

c. Goals: To prevent loss of control with possible resultant loss of the aircraft as a result of loose and/or inadequate restraint.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The specific problem addressed concerns the potential loss of Naval aircraft when the pilot cannot regain control during unstabilized flight due to the incompatibility of the tight restraints for uncontrolled flight episodes with long term pilot comfort/tolerance.

b. Payoff: Lost pilots cost the Navy about 1.5 million each. The successful conclusion of this effort may result in the difference between recovery on one hand, and the loss of the aircraft and perhaps the pilot also on the other.

c. Risk: It is believed that the task is within the current state-of-the-art and presents little or no risk.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

This information is useful to the Air Force, and is passed on both by oral communication and by distribution of technical reports.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/Rocket Plume Containment
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: C. Woodward, T. Zenobi
Contributing Laboratory/Center: NWC, China Lake
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Develop a protective system to shield the ejecting crewman from burns due to his ejection seat rocket plum for new Navy technology ejection seat.

b. Approach: Define problem. Investigate protective system design alternatives. Determine if feasible solution exists, and if so, initiate and development of desired system.

c. Goals: Protect ejected crewmen from rocket plume burns from his own seat.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The potential for thermal injuries is great to crewmen in vectored - rocket ejection seats because of high local temperature prior to cockpit exit and difficulty in venting/containing the rocket plume during exit.

b. Payoff: Rocket powered ejection seats offer the Navy an opportunity to greatly enhance escape capability. In order to capitalize on this opportunity, a method must be devised to prevent the crewman from being burned by the exhaust from his seat rocket.

c. Risks: The objective of this program is to minimize the risk associated with rocket powered escape systems. Estimated probability of success is 50/50.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other ____

Although this program is directly related to a Navy program using a pure rocket system for escape, certain benefits may be applicable to the Air Force. Tech reports will be issued to inform them of progress.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In Flight Escape Systems/Improved Torso Harness
Program Status: On-going ☐ Proposed ☐ Planned ☑ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: C. Woodward/K. Miller
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-3408
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Develop an improved torso harness utilizing new concepts to replace inadequate fleet harnesses.

b. Approach: To study, plan, develop and demonstrate feasibility of a new torso harness.

c. Goals: To reduce injuries resulting from torso-harness slack during ejection and parachute deployment by 25%. To reduce parachute-divestment time by 75% on touchdown. To reduce egress time in on-deck emergencies by 50%.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Navy testing and statistics have indicated the inadequacies of the present MA-2 torso harness.

b. Payoff: Eliminate the contribution of present torso harnesses to injuries and fatalities during in-flight instability, crashes, ejection, parachute deployment and touchdown on land and water and emergency egress on-land/on-deck of carrier.

c. Risk: System design must not compromise existing pilot procedures and functions, and must not add additional encumbrances. This is considered to be a low risk program, based on restraint development work in other programs.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☐ USAF ☐ TriService ☒ Other

As this is directly applicable for replacement of an MA-2 harness used only in the Navy, application to Air Force requirements would require study. Program coordination exchange with the USMC and Air Force will be maintained by the Navy.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: In-Flight Escape Systems/Fluidic Gyro Adaptation to Seat Steering
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215)441-2189
Project Engineer: C. Woodward
Contributing Laboratory/Center: NOS
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To determine the feasibility of using a fluidic gyro or rate sensor to provide the angular directional and rate information required to properly control through a microprocessor the new Maximum Performance Ejection Seat (MPES) in a upward trajectory from any attitude.

b. Technical Approach - The response characteristics, including start-up and stabilization times, of existing fluidic gyro and rate sensing devices will be obtained and analyzed to determine compatibility with vertical seeking control requirements. If data prove current systems are unacceptable, new design concepts will be investigated. All systems must be adaptable for operating in the known force environment and through a microprocessor.

c. Goals - To demonstrate that a fluidic gyro is a viable attitude and rate sensor for a vertical seeking aircrew escape seat, thus eliminating the need for a continuously running electro-mechanical gyro.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - The electro-mechanical gyro system used in feasibility tests to date of the Vertical Seeking Escape System must be in continuous operation during flight because of its unacceptablly long start-up and stabilization interval.

b. Payoff - The relatively short start-up and stabilization time (anticipated 100m sec) characteristic of fluidic gyros will provide a more reliable and economical attitude reference for controlling the trajectory of the ejection seat through a microprocessor than a continuously running electro-mechanical gyro system.

c. Risk - Current start-up time for fluidic gyros is approximately 1 sec. A new design under consideration is expected to bring this time down to the required 100ms. This is a new and demanding application of fluidic gyros and entails some risk in the high-g environment.

d. Applicable STO's - SL 12-D-9, 12-G-16. High Priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other NASA

Progress in this effort is being communicated to all services through personel contacts and published reports.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection

Sub-Task Title: Aircrew Seating & Restraint Systems/Crashworthy Passenger Seat

Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978

Performing Laboratory/Center: NAVAIRDEVCEN

Technical Coordinator/Phone: R. Crosbie (215) 441-2189

Project Engineer: J. Micciche/L. Domzalski

Contributing Laboratory/Center:

Cognizant SYSCOM Code: AIR-340B

CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Develop a passenger seat which offers the occupant all the safety, comfort and protective features that "state-of-the-art" seat technology has to offer the military passenger.

b. Approach: Technical proposals will be evaluated for best design concept, which includes energy attenuation devices to enhance crashworthiness, lightweight materials for seat structures, and improved methods of restraint. Prototypes will be evaluated under dynamic crash-simulation testing.

c. Goals: To improve military passenger safety and comfort.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Current military passenger seats are built to MIL-S-7877B which is 21 years old. Seats resulting from this specification do not utilize crashworthiness technology available today. Military passengers now have archaic protection from impact and other potential safety hazards.

b. Payoff: Crashworthy passenger seats would minimize fatalities and injuries in survivable crash situations.

c. Risk: A moderate risk exists in developing a prototype to meet the crash-attenuation requirements of a 95% potentially survivable crash for large fixed-wing and transport aircraft.

d. Applicable STO's: PN 11-D-1; SL 12-D-9. Critical.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☐ TriService ☐ Other FAA/NASA

Current efforts in passenger seat development by FAA and NASA are being coordinated via Government Agency Fixed Seating Panel. Seat systems developed under this effort have direct application to civil aviation.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Aircrew Seating & Restraint Systems/Crashworthy Gunner Seat
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: R. Crosbie (215)441-2189
Project Engineer: J. Micciche/L. Domzalski
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Develop gunner's Seat System which provides restraint and mobility features to operate the machine guns and prevents inadvertent falls from A/C. Design incorporates "fixed" A/C installation which is crashworthy in the side-facing configuration and which provides ballistic protection via modular armored panels. The modular feature allows the armor to be removed during non-hostile missions.

b. Approach: Design/Performance requirements of crashworthiness, energy-absorption lateral restraint, mobility and armor protection will be applied to a contract procurement of functional prototypes. Hardware will be dynamically tested and evaluated. Design modifications and final R&D evaluations will be conducted leading to full scale development either as a retrofit version for aircraft update programs or as a candidate seat system for proposed aircraft.

c. Goals: 25% of all helicopter fatalities/injuries in potentially survivable crashes are gunners/crewchiefs. This results in five fatalities and twenty major injuries per year in survivable crashes. A crashworthy gunner seat should virtually eliminate the seat hazard.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Helicopter gunners and crew-chiefs are required to operate in open doors/windows of aircraft, often in turbulence or during evasive maneuvers, with little more than rudimentary lanyard restraints for protection. Frequently seats are installed by operational personnel in the field which are inadequate in terms of structural strength, crashworthiness, restraint/mobility requirements, and the absence of armor protection.

b. Payoff: Increased structural integrity (crashworthiness) 48-G vertical; 24-G forward/lateral. Increased mission effectiveness. Increased crew morale.

c. Risk: Some risk is involved in the design of the side-facing installation requirements of the Gunner Seat. This could result in modifications to the feasibility prototype and subsequent repeated TECHEVAL.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☐ TriService ☐ Other

Program coordinated with Army via annual Government agency Fixed Seating Panel meetings, distribution and exchange of reports, specifications and drawings. In addition, a joint Army/Navy (Eustis/NADC) test program on UTTAS Seating Systems is in progress.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Aircrew Seating and Restraint Sys./Crashworthy Lightweight Crewman Seat
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct. 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: J. Micciche/M. Katzeff
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: The objective is to develop a lightweight, crashworthy pilot/copilot fixed seat for rotary and fixed-wing aircraft.

b. Approach: Technical proposals will be evaluated for best design concept which includes attenuation devices to enhance crashworthiness, lightweight materials for seat structures, and improved methods of restraint. Prototypes will be evaluated under dynamic simulation testing.

c. Goals: In 95% of all potentially survivable accidents for crewmembers, reduce current fatality and injury rate by 20 and 100 respectively, per year. Reduce current seat weight by 10 lbs. Minimize crewmember discomfort and long-term fatigue.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Present aircrew seats do not adequately absorb energy. They expose the aviator to excessive g-transmission from the aircraft structure and leave the floor if the peak g-value exceeds 48 g.

b. Payoff: The g-value and force will be moderated by energy absorbing structure in the seat. This not only reduces the rate and peak value of force transmission to the aviator's restraints and body, but also lessens the force between seat and floor, further reducing the probability of breakaway and injury or fatality.

c. Risk: The theory of energy absorption and weight saving features used in the fixed seating design have already been proven in armored seat development programs. This previous work has eliminated any major risk that this program might not be carried to a successful conclusion.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other FAA, NASA

Program coordinated with NASA and FAA via yearly meetings of Government Agency Fixed Seating Panel and distribution of reports, specifications and drawings. Involvement is anticipated in FY-78.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Aircrew Seating & Restraint/Personnel Retention Restraint
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: J. Micciche/L. Domzalski
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Design improved Personnel Retention Restraint which is compatible with crew protective clothing; provides over-board retrieval capability, mobility, emergency egress, and is compatible with seat attachments.

b. Approach: Phase I: Investigate feasbility of incorporating energy-attenuating devices such as ROTO-SHOK E/A'a & E/A webbing materials with current operational restraints.
Phase II: Incorporate results of Phase I study in Design Criteria for development contract.

c. Goals: Correct Part I & Part II deficiencies identified in recent NATC tests of current operational restraints. Eliminate lower back injuries attributed by NAVSAFCEN to restraint system deficiencies. Design to cost goal of less than $100 per unit.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Current retention harnesses are not designed to provide emergency restraint-protection to crewmen required to perform "stand-up missions". Crewmen often do not wear any restraint since current models often degrade their mission effectiveness. This situation often results in unnecessary lower back injuries and fatalities.

b. Payoff: Increased safety and survivability. Increased mission effectiveness. Reduced equipment requirements (i.e. separate harness not required) if an integrated flight suit/restraint system is proven feasible.

c. Risk: Complete emergency restraint in stand-up mode is high risk factor. Integration of restraint with present flight suit is considered moderate risk. Compromise solutions to these design goals will nevertheless result in an improved restraint.

d. Applicable STO's: PN 11-D-1; SL 12-A-3, 12-G-14. Critical.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☐ TriService ☐ Other Can. Air Force

Project developments to be coordinated with Army and Canadian Air Force via yearly meetings of Government Agency Fixed Seating Panel and the distribution of reports, specifications and drawings.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62441N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Aircrew Seating & Restraint Systems/Variable Load E/A Concept
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: R. J. Crosbie (215) 441-2189
Project Engineer: J. Micciche/L. Domzalski
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To investigate the feasibility of improving the operational performance of energy attenuator systems in crashworthy seats by incorporating a passively controlled variable limit load concept in their design.

b. Approach:

PHASE I - System design criteria will be established by analyzing the results of tests to determine the influence of various design parameters on the performance of energy attenuator systems.

PHASE II - A prototype variable limit load energy attenuator device will be designed, fabricated, tested, and evaluated. Various load control mechanisms will be included in the evaluation.

c. Goals: To reduce the G-loading experienced by light occupants of a crashworthy seat during a crash by as much as 6G.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The crashworthiness of energy attenuating seats have been compromised in order to satisfy the weight spectrum (3% through 98%) requirements.

b. Payoff: The probability of injury/death during a crash will be significantly reduced because E/A will be optimized for entire military population (3% through 98%).

c. Risk: Risk of success is moderate. Design concepts have been formulated indicating feasibility.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☐ TriService ☐ Other

This program will be coordinated with the Army (Applied Technology Laboratory). Program results will have direct application to Army crashworthy seat systems.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Aircrew Seating & Restraint Sys./Crashworthy Seat Design Parametric Sty
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN / ACSTD
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: J. Micciche/M. Katzeff
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide a systematic basis for efficiently designing optimized crashworthy seat systems having specific dynamic response characteristics.

b. Approach: Crashworthy seat systems will be described by mathematical models which will be verified for a variety of crash impact signatures (G-time profiles) while varying the following major parameters:

1. Energy Attenuator (E/A) profile
2. Weight and size of test dummy
3. Seat cushion design

c. Goal: To minimize seat occupant injuries during a crash by making more efficient use of the available stroke distance for E/A action.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Unnecessary bodily injuries occur to crashworthy seat occupants during a crash because more efficient utilization of the available stroke distance for E/A action is not made in the design of the seat system.

b. Payoff: Maximum protection will be provided to crashworthy seat occupants during a crash through the use of a seat system which requires less time to design, develop, and test.

c. Risk: Performance improvements have already been achieved in isolated applications of this concept (i.e., notched E/A systems) and little technical risk is involved in broadening its scope although much testing will be required.

d. Applicable STO's: PN 11-D-1; SL 12-D-9. Critical.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☐ TriService ☐ Other

This project is a joint venture with the U.S. Army with plans and progress being communicated during scheduled design review meetings.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Aircrew Seating & Restraint Sys./Helo Crew Comfort Study
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: R. Crosbie (215) 441-2189
Project Engineer: J. Micciche/M. Katzeff
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To develop design criteria for helo seating systems which will improve crew comfort.

b. Approach: A detailed study will be performed to determine the criteria for helo seat design to provide optimal crew comfort during long missions. This will be followed by the design, fabrication, and evaluation of a mock-up seat. A prototype seat will then be fabricated and tested both in a simulator and in a helicopter.

c. Goals: To increase helicopter mission effectiveness by providing a seating system for the crewmen which will minimize the fatigue and pain in both the back and leg muscles that result from long-duration flights.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The most common complaint of helo crewmen during long duration missions is seat discomfort. The effect of fatigue and pain which develop in the lower back and leg muscles are sufficient to adversely affect mission performance.

b. Payoff: A major increase in both helo mission effectiveness and crew morale.

c. Risk: Some risk is involved because current standards for military cockpit geometry and seating will have to be modified to reflect state-of-the-art seat technology.

d. Applicable STO's: PN 11-D-1; SL 12-D-4, 12-A-3. Critical.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☐ TriService ☒ Other

Program progress and results will be communicated to other government agencies during annual meeting of the "Fixed Seating Panel" and through published reports.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Parachute Systems/Aircraft Gliding Escape System
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: National Parachute Test Range
Technical Coordinator/Phone: R. J. Crosbie (NADC) (215) 441-2189
Project Engineer: D. Goodrich /J. Matsuo (NPTR)
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide an ejecting aircrewman with an aerodynamic decelerator having a wide range of reliable performance whether at low altitude and low speed or in a high altitude high Q environment. It should incorporate provisions for gliding flight and a degree of maneuverability.

b. Approach: Survey state-of-the-art of gliding parachute systems and identify critical performance parameters, devise innovative techniques to overcome opening time, opening shock, and high speed reliability problems; draft performance specifications; fabricate/procure, test and evaluate promising configurations.

c. Goals: To change the parachute lift/drag ratio from the present value of 0.10 to 1.0 or higher with delayed deployment at high-Q to prevent excessive loads due to high opening shock.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Ejectee captures in Vietnam, needless drownirgs through parachute entanglements, bone injuries during landings on perilous terrain, and delays in retrieval from inaccessible terrain, together, demand that maneuverability be incorporated in Navy parachutes.

b. Payoff: Reduce the number of ejectee crewmen captured by the enemy during war; reduce injuries from parachute landings by crewmen being able to select their landing terrain; minimize the parachute canopy-suspension line-crewman entanglement problem in the water.

c. Risks: Main risk is the difficulty of overcoming the high opening shock problem and of packing the chutes into existing containers. Advanced technology materials, new packing concepts, and new construction techniques could help to solve these problems if properly applied.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other
The current USAF 4 line-release jettisoning lanyards system is planned to be incorporated into Navy parachute systems. The ram air flexible/deployable wing, developed for sporting field, has been tested for application on Navy RPV's and Navy personnel.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Parachute Systems/Fire Resistant Parachute Canopy
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: National Parachute Test Range
Technical Coordinator/Phone: R. J. Crosbie (NADC) (215) 441-2189
Project Engineer: D. Goodrich, J. D. Boone (NPTR)
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To develop a fire-resistant personnel parachute system of commercially available material, which will retain or improve upon present performance, weight and bulk.

b. Approach: The personnel parachute will be redesigned so as to use aromatic polyamides (probably "Kevlar-29") instead of nylon and still remain within present parameters of weight, bulk, and performance.

c. Goals: The goal is 10-second exposure to JP fuel fire with functional survival.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The development of very low-level, low-velocity ejection seats has created a situation where parachutes (canopies, tie lines, suspension lines, etc.) have been burned or melted, as when they encounter the fire ball or explosion flash from the aircraft.

b. Payoff: Reduce fatalities from fire/heat - destroyed canopies, tie lines, suspension lines, etc. to zero.

c. Risks: The available aromatic polyamide fibers are of heavier denier than the presently available nylon. The risk involves the difficulties of re-designing components in order to remain within present weight, bulk, and performance parameters.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

The USAF is engaged in a longer term effort, covering the entire parachute system and not limited to commercially available materials. The Navy effort is the only effort expected to produce a fire-resistant service parachute in or near FY-79.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Parachute Systems/Advanced Parachute Canopy Design
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: National Parachute Test Range
Technical Coordinator/Phone: R. J. Crosbie (NADC) (215) 441-2189
Project Engineer: D. Goodrich/J. D. Boone (NPTR)
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To improve consistency of parachute-canopy operation, simplify manufacturing procedures, improve quality control, reduce opening shock loads, reduce weight and bulk and improve operational envelope as a result of basic design capability.

b. Approach: Investigate designs, fabrication methods, and types of materials which appear to further objectives. Procure samples of such materials for test and, where they appear promising, construct prototype canopies for tests.

c. Goals: Increased scope of emergency escape and recovery enveloped; also, a three-fold increase in system reliability, a 40% reduction in procurement cost, and a 20% savings in weight and bulk.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The conventional parachute is composed of approximately 112 separate pieces of fabric, each of which is seamed on either three or four sides. Sudden parachute deployment creates a shock wave, the traveling whip at which causes failures at the higher-density, stiffer seams, such damage having occurred in every parachute involving a high-speed ejection. These seams also contribute to cost, weight and bulk of the parachute.

b. Payoff: Seam damage will be minimized by the use of greater fabric widths to produce canopies with larger and fewer panels. Variable porosity materials will be used to reduce the 8000 lb. high Q opening shock registered at the risers to a value of 6500 lbs.

c. Risks: The primary risk of this effort is the difficulty of obtaining desired widths of certain fabric materials on a commercially available basis.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☒ TriService ☒ Other

Effort is being coordinated with the USA (Natick), USAF (WPAFB) and with industry. It has been agreed that the Navy will pursue R&D with knit fabrics, and the USAF with stretch-woven fabrics for improved porosity benefits, each reporting results to the other. Program status update will be provided at annual Triservice Coor.Mtg

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Parachute Systems/New Materials and Construction Techniques
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: National Parachute Test Range
Technical Coordinator/Phone: R. J. Crosbie (NADC) (215) 441-2189
Project Engineer: D. Goodrich/ J. D. Boone (NPTR)
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To develop new materials, construction and packaging techniques which will increase the reliability, decrease the life cycle cost, and eliminate the requirement for shipboard logistic support for personnel parachutes.

b. Approach: Conduct laboratory experiments designed to determine the effect of long-term storage in an operational environment on the strength of materials/ joints used in current and proposed escape systems, conduct laboratory creep, cyclic fatigue tests under various environmental conditions on recovery system components.

c. Goals: To provide a rational basis for extending the inspection and repack cycle for current escape systems to 3 years, and for projected systems employing proposed packaging techniques to 5 to 7 years.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Present Navy parachute systems must be removed from the aircraft, inspected and repacked every 217 days. No experimental data is available to justify this limit. The establishment of service life, maintenance schedules/ intervals and methods, and repair procedures, for escape and recovery systems require a thorough knowledge of the structured behavior of textiles and polymer systems. This behavior must be further quantified under various environmental conditions to prevent either unsafe or overly conservative guidelines.

b. Payoff: The elimination of the requirement for shipboard logistic support for personnel parachutes.

c. Risk: The collection of sufficient data and the application of known techniques is all that is basically required to reach stated goals. Probability of success --95 percent.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☒ Other

The NPTR is pioneering in this area. The results of this program are applicable to all aircraft employing ejection seats and/or recovery systems. Data will be made available at the annual tri-service coordination meeting.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Parachute Systems/Energy Absorbing Devices
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: National Parachute Test Range
Technical Coordinator/Phone: R. J. Crosbie (NADC) (215) 441-2189
Project Engineer: D. Goodrich/L. Wickman (NPTR)
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide emergency egress systems with energy absorbing devices which will limit the deceleration forces applied by the parachute to aircrewmen during deployment.

b. Approach: Metal deformation devices, high elongation polymers, and tearing devices will be constructed and tested. Selection for application to existing parachute/ejection seats will be made not only on the basis of the system's ability to provide adequate force limitation but on its low bulk/weight/cost.

c. Goals: To reduce peak decelerations during parachute deployment from 40g to a more acceptable human tolerance limit of 15g.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Aerospace recovery systems generate large amounts of energy to be dissipated in a short time with resulting high stresses. Of particular concern are the high stresses associated with deployment during High-Q conditions and with the opening shocks of snatch systems, rocket or mortar systems, aerial retrieval of sattelite packages, and helicopter recovery systems. At the same time, the structures of the recovery system and the human body involved are not strong enough to withstand high forces.

b. Payoff: The integration of energy absorbing devices into emergency egress systems will extend the useful range of the system; permit the use of simpler systems; and reduce the chance of failure, damage and injury/death.

c. Risk: The risk of this program is considered minimal. The task primarily involves the selection and adaptation of proven E.C. concepts to the specific needs of recovery systems.

d. Applicable STO's: SL 12-D-9, 12-G-16. High priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other USAF, NASA

The stated problems are common to all aerospace recovery systems and to some ground base deceleration systems. Joint support has resulted in the USAF assuming some of the cost of devices to be tested.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Parachute Systems/Aero-conical Vacuum Packaged Parachutes
Program Status: On-going ☐ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: National Parachute Test Range
Technical Coordinator/Phone: R. J. Crosbie (NADC); 215/441-2189
Project Engineer: D. Goodrich/G. R. Drew
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Establish feasibility of vacuum packaging of aero-conical parachute canopy for extended service in the operational environment.

b. Technical Approach - Hermetically sealed vacuum/pressure packaging techniques will be applied to packaging the new aero-concial parachute. "One time" factory packaging with strict quality control will be used to obviate the necessity for repacking. Test units will be manufactured and subjected to environmental tests, flight tests, and ejection tests to prove the concept feasible.

c. Goals - Provide 5-7 year stowage life. Reduce maintenance costs by 95%. Reduce parachute life cycle costs by 50%. Reduce volume of container by 60% from the present 1.1 cu. ft. for NES-12/16 units. Also reduce weight by 20% from the present 21 lb.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Parachute assemblies require periodic disassembly from their containers, full inspection and repacking. This procedure is not only costly but accelerates deterioration of components and provides repeated opportunities for packing errors.

b. Payoff - To eliminate most or all of parachute repacking requirements and with it the need by squadrons for complements of repacking personnel and packing rooms. Also, with the aid of well organized, continuous factory quality control, reliability will improve and life-cycle costs will fall.

c. Risk - With the solution of previous technical problems including delamination of plastic composite covers and seal failures, the probability of meeting the objectives is now 95%. Have subjected two of last year's packed container models to the full spectrum of environmental MIL-STD specs. three times in succession.

d. Applicable STO's - SL 12-0-9, 12-G-11 High Priority

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☒ TriService ☒ Other

The NPTR is pioneering in this area. Both the Army and Air Force are monitoring this Navy effort and will be provided updated information at the annual Tri-Service meeting.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Habitability/Personnel Protection
Sub-Task Title: Personnel Escape Propulsion/MICRAD Vertical Sensor
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 May 1978
Performing Laboratory/Center: Naval Weapons Center
Technical Coordinator/Phone: R. J. Crosbie (NADC) (215)441-2189
Project Engineer: W. J. Stone (NWC)
Contributing Laboratory/Center: National Parachute Test Range
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective: To demonstrate the feasibility of using microwave radiometry (MICRAD) technology as an aircraft-independent, vertical sensor, on an aircrew escape seat.

b. Approach: A MICRAD auto-pilot will be assembled, bench tested and the data analyzed. The auto-pilot will be mounted on an existing seat system with steering capability and tests conducted from adverse attitudes. The capability of the auto-pilot to command a vertical maneuver and supply seat rate data will be evaluated.

c. Goals: To demonstrate that MICRAD is a viable attitude and rate sensor for a vertical seeking aircrew escape seat, thus eliminating the need for depending on aircraft avionics.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem: It has been recognized that vertical seeking capability has the potential to substantially reduce both fatalities and injuries during emergency ejections. The system presently under development requires attitude initialization from the aircraft AHRS. Vertical seeking capability will be made more reliable with a totally self-contained system.

b. Payoff: The MICRAD sensor is a simplier, more reliable, more economical attitude reference than a continuously running inertial system. The MICRAD system will function normally during ejections irrespective of aircraft avionics failures.

c. Risk: Analysis of available MICRAD data indicates the probability of success in sensing attitude is good. Rate sensing capability is not as well defined. However, that function could be performed in a conventional manner without degrading the desired independence of the MICRAD attitude reference system.

d. Applicable STO's - SL 12-D-9, 12-G-16 High Priority

3. Program Coordination

Other Navy ☐ USMC ☒ Army ☐ USAF ☒ TriService ☐ Other NASA

The NWC pioneering effort has relevance to all aircraft employing ejection-seat systems. All military services, as well as NASA should benefit. They are being kept advised of program progress through personal contacts, published reports, and Tri-Service Coordination meetings.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Aircrew Thermal Protection Systems
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215/441-2189
Project Engineer: J. T. Micciche/S. Reeps
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective: To develop a dual purpose heating/cooling liquid-loop undergarment for helicopter pilots and co-pilots.

b. Technical Approach: Develop a liquid-circulating garment, an aircraft mounted cooling generator and an automatic controller.

c. Goals: To provide thermal comfort for the pilot and co-pilot by maintaining the mean skin temperatures between 30° and 34.5°C; to improve performance of users by minimizing build-up of body heat in ambient temperatures up to 46°C (115°F).

2. Justification

a. Problem b. Payoff c. Risk

a. Problem: Degradation of performance due to heat built-up can lead to accidents or decisions by helicopter aircrewmen to wear less survival equipment, thus threatening ability to survive in the event of a ditching accident.

b. Payoff: Performance will be improved without additional tasks for the aircrewman. If the aircraft is downed on land or water in a cold latitude, the liquid-circulating garment will be available for connection to the DAPS body-heating source for survival.

c. Risk: Feasibility of maintaining stable automatic skin temperature control is still to be proven.

d. Applicable STO's: PN 11-D-1, 11-6-6, critical.

3. Program Coordination

Other Navy ☒ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other _____

Technical Report.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Rocket Plume Avoidance Design Criteria
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215/441-2189
Project Engineer: J. T. Micciche/A. Stoll
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - With the advent of multiple-place aircraft with ejection capability, personnel are subject to exposure to flames from preceding or simultaneous ejections of other crew members. It is the objective of this work to establish the temperature-time parameters for burns from such exposures and to generate design criteria for protective devices or clothing or for elimination of the hazard by trajectory design.

b. Technical Approach - Laboratory simulations of the plume, exposure of anesthetized animals to the flames, measurement of flame flux and skin temperatures, with observation of burn effects will be carried out and results used to establish the data base for design of protective systems.

c. Goals - Prevent thermal injury on ejection through flame-protective means and/or redesign of seat trajectories to avoid danger envelopes as described by the measured parameters and biophysical observations above.

(New start will be made on protection development.)

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Thermal injuries have been experienced in simultaneous or tandem ejection from multi-place aircraft.

b. Payoff - Avoidance of injury and increased aircrew survivability in ejection operations in multi-place aircraft.

c. Risk - The major risk is that the subsequent development problem may prove to be very formidable.

d. Applicable STO - SL 12-0-9. High Priority.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Although tri-service interest, no similar effort is being conducted elsewhere. Coordination of this effort will be effected with known counterparts in the three services through technical reports and personal contact.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62241N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Arctic Anti-Exposure System
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215/441-2189
Project Engineer: J. T. Micciche/V. Robbins
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 05/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - Develop an anti-exposure system for protection of both ambulatory and injured survivors of helo and patrol aircraft on frigid terrain.

b. Technical Approach - Modify the DAPS (Downed Airman Power Source) for portable on-person use and coaction with the LLG (Liquid-Loop Garment) that will be worn for body heating/cooling in the aircraft. Supplement with appropriate light-weight insulative body and limb outer clothing, together with sleeping-bag means for period of inactivity, and design into a compressed, vacuum-sealed package adapted for tear-ship opening in emergency.

c. Goals - Provide a light-weight, low-bulk, body protection system for emergency exposure on frigid terrain.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Many naval missions are flown in winter and in cold latitudes, requiring supplementary thermal protection in the event of emergency landing or ditching.

b. Payoff - Twenty-four hour extension of aircrew land-survival time in frigid latitudes; improvement of survivor mobility via reduced bulk and weight of gear.

c. Risk - The availability of DAPS, already demonstrated in the self-encapsulating life raft, removes the element of risk from development of a compact system.

d. Applicable STO's - SL-12-G-16; SH 5-C-8. High Priority.

3. Program Coordination

Other Navy ☒ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other _____

Technical Reports.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Multi Wavelength Laser Protective Systems
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie 215-441-2189
Project Engineer: J. Micciche/G. T. Chisum (60231)
Contributing Laboratory/Center: N/A
Cognizant SYSCOM Code: AIR-340
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Technological advances in lasers and related fields have been extensive. The threat of laser energy to the eyes includes both permanent and long lasting temporary effects. The objective is to assess the permanent and termporary hazards and develop a means of protecting the eyes of operating personnel through the application of holographic techniques against the hazards.

b. Technical Approach: Assess the range of eye effects and hazards produced by laser emission exposure and the protective requirements. Review technological areas with application potential. Develop prototypes of protective equipment. Assess prototypes for effectiveness.

c. Goals: Provide useable eye-protective equipment to prevent eye damage from the range of laser energies which may be encountered in an operational environment when the specific laser is not known.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Proliferation of lasers in field use poses a growing hazard to operational personnel. Eye protection must be provided for operational personnel. Currently urgent projects have been instituted to provide laser-specific eye protection as in the A6-E TRAM. No multiple wavelength filter has been developed by either the USAF or Army for application in a flight environment. Dynamic protection developed for other applications is not adequate. No system is available to protect against lasers when the wavelength of threat is not known.

b. Payoff: The eyes of aircrew personnel will be protected from over exposure to laser energy when the wavelength of concern is unknown.

c. Risk: The risk is medium to low. It is felt that the technology is available for application to the problem

d. Applicable STO's: SH 5-A-3; SL 12-D-11. High Priority

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other ____

All three services have a problem in the area of eye protection. This project is being coordinated with Army and Air Force projects in the area. Visors developed by the Air Force are being used in a separate project to provide wavelength specific protection.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Maximum Material Temperatures for Safe Skin Contact
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215-441-2189
Project Engineer: J. T. Micciche/A. Stoll
Contributing Laboratory/Center: N/A
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide design criteria for thermally safe operating conditions for aircrews in normal flight in current and advanced aircraft.

b. Technical Approach: Generate basic data on production of pain and burns on contact with various materials of different thermal properties and delineate the limits of non-injury exposure to heated surfaces which may contact bare skin in the projected "shirt sleeve" environment.

c. Goals: To derive a mathematical formulation for predicting the maximum permissible temperature of any material for safe contact with bare skin solely from a knowledge of the thermal constants of the material and to provide protection where necessary and engineering guides for selection of thermally safe materials for A/C cockpit construction.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: In the selection of materials for cockpit controls and equipment, the need exists to know the maximum allowable temperature for components which aircrewmen must contact with bare hands. The need also exists to protect aircrewmen in the "shirt-sleeve" environment from injury produced by contact with cockpit surfaces.

b. Payoff: Generation of experimental data on living human skin in contact with materials from conductors to insulators will provide the basis for mathematical analysis so that design engineers can determine the maximum permissible temperature for any given material.

c. Risk: Preliminary results indicate that this effort is in the low-risk category. A subsequent development effort may be faced with a formidable challenge and risk.

d. Applicable STO's: PN 11-D-1; SL 12-G-14. Critical.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other _____

Technical Reports. No other agency is performing research in this area.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Thin Film Communications
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215/441-2189
Project Engineer: J. T. Micciche/R. Loewenstern
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 05/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - To develop lightweight, low-profile, highly stable communications components for integration into the helmet/mask system worn by naval aircrewmen.

b. Technical Approach - Fabricate, test and evaluate microphones and earphones employing transducers of thin, polarized, polymeric films. Identify polymeric film materials offering optimum performance characteristics and design flexibility.

c. Goals - To achieve a 75% reduction in component weight and 50% reduction of component size of the communications portion of the helmet/mask system worn by naval aircrewmen.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Undesirable helmet-associated weight and bulk tend to grow as new functions and better subsystem performance are demanded, thus requiring focussed effort to minimize both. Microphones and earphones cannot be further compacted without resorting to such new transducer tachnology as is offered by certain thin, polarized, polymeric films.

b. Payoff - Use of these transducers in the earcups matching the impedance of the aircraft communications system without need for the present impedance transformer. The lower earcup profile reduces both bulk and the amount of extraneous sound pickup via its outer surface, a small amount of the space saving then being reinvested into better surface damping. Microphone transducers of this type are more stable under various environmental conditions and their smaller size will enable reduction of oxygen-mask profiles.

c. Risk - Risks associated with prior compact substitutes are avoided. No new risks have yet been identified.

d. Applicable STO's - SL 12-G-14; PN 11-C-12.

3. Program Coordination

Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other

Progress annually reported to DDR&E Tri-Service Flight Environmental Working Group.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Full Face Helmet System
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. Crosbie 215-441-2189
Project Engineer: J. Micciche/J. Castine
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Develop a light-weight, full-face, helmet system for optimizing protection from windblast, canopy implosion or other imp t, and integrating therein protection from both CBW and cockpit-FOD entry into eyes.

b. Technical Approach: 1) apply recently-established, ACM helmet technology (materials and construction) and integrate established CB-protection features into a new helmet design. 2) Solicit contractors for new technical approaches.

c. Goals: 1) 4-lb. max. weight with helmet cg at head cg ≠ 1 inch.
2) Unlimited upward/downward vision
3) Fully integrated target-acquisition system

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Previous full-face helmet systems, despite cockpit-implosion/bird-strike protection and proven operational acceptability for a large percentage of the VA community, were not adopted because, in the prior state of helmet arts, their weight and visual restrictions overbalanced the value of facial and eye protection achieved.

b. Payoff: 1) Optimized facial/head protection in flight and emergency, plus CBW adaptability
2) Absolute minimum of weight and cg unbalance
3) Optimized command of visual field and visual target acquisition
4) Elimination of face mask and problems associated therewith and improvement of sound attenuation

c. Risk: Basic technology building blocks are available; therefore, risk is minimal

d. Applicable STO's: SL 12-D-9; AW 8-A-8. High Priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Coordination through Tri-Service Flight Environment Working Group and direct liaison Life Support SPO, USAF.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Protective Clothing and Devices
Sub-Task Title: Fuel Fire Facility Scale-Down
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215-441-2189
Project Engineer: J. T. Micciche/A. Stoll
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide an all-weather, self sustaining, indoor fuel-fire facility for the generation of data for the evaluation of burn-protective capacity of personnel gear for naval aircrewmen and flight-deck personnel in full-scale fuel fire exposures.

b. Technical Approach: To design a sealed-down indoor version of the existing fuel-fire facility for providing realistic data for evaluation of personnel gear in full-scale fuel fires.

c. Goals: Construction of an indoor facility with provision for automatic fuel dispersion, ignition, timing, control and data collection.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: When conducting experiments via the existing fuel-fire facility, environmental considerations, such as wind, rain, frost, etc., dictate when exposures can be conducted without an adverse effect upon the validity of data for protective-capacity analysis.

b. Payoff: An indoor facility will provide more timely and consistent results in the analysis of data for burn protection of naval aircrewmen. Also, it will alleviate the need for additional personnel in the conduct of the experimental phase of the full-scale fuel fire exposure.

c. Risk: This effort is in the medium-to-high-risk category.

d. Applicable STO's: PN 11-D-1; SL-12-G-14. Critical.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☒ TriService ☐ Other

Through direct contact with USAF and U.S. Army as well as Tri-Service Consolidation Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Survival and Rescue Equipment
Sub-Task Title: Inflation Systems Development
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215/441-2189
Project Engineer: J. T. Micciche/E. McClain
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - (1) Evaluate feasibility of using air-aspirating inflators for military life rafts; (2) Evaluate feasibility and comparative effectiveness of pyrotechnic inflation systems vs standard CO_2 inflation system for multiplace life rafts; and (3) Determine feasibility of a single-motion CO_2 inflator for life preservers.

b. Technical Approach - (1) Procure and test available air-aspirator systems under various temperature conditions; (2) Procure and test pyrotechnic inflation system to determine whether uncorrectible problems such as stowage hazard, heat damage to raft, toxicity or combustibility of effluent gases, condensation of H_2O vapor, etc., impair performance or safety; and (3) Fabricate and test single-motion life-preserver inflation valve for ease and reliability of operation.

c. Goals - (1) To improve reliability of life-raft inflation at all temperatures and (2) To simplify motion required to inflate life preservers.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - (1) Inflation of life rafts at low temperatures with existing CO_2 inflation system can take as long as 5 min causing severe exposure problems for survivors which may result in death; (2) The multidirectional motion required to inflate life preservers causes problems in survival situations which may result in death.

b. Payoff - (1) Reliable and fast life raft inflations throughout water/air temperature range; (2) Reduced maintenance costs if pyrotechnic inflation system proves feasible; and (3) Enhance survival probability via improved dependability of life-preserver inflation.

c. Risk - Potential non-correctible failure of raft inflation system to pass one or more tests.

d. Applicable STO's: SL 12-D-9; 12-G-16. High Priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Technical report and liaison with USAF.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Survival and Rescue Equipment
Sub-Task Title: Light Emitting Diode Water Switch
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. H. Crosbie; 215.441-2189
Project Engineer: J. T. Micciche/J. R. McElhenney
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Develop a fail-safe, water-activated parachute release for use in Navy aircraft.

b. Tachnical Approach - Evaluate a miniaturized electronic device which, upon water entry, will automatically release the parachute harness fittings using an electrically ignited, explosively actuated, piston mechanism.

c. Goals - In a recent seven year period, 26 drownings were caused by dragging due to high winds, entanglement in canopy lines, failure to inflate flotation equipment, or a combination of these conditions. The goal embodies the Naval Safety Center's belief that all 26 could have been saved with the proper equipment.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - The drowning of aircrewmen following successful overwater ejections is an ever-present problem. The primary cause of drownings is the inability of ejectees to release their parachutes and inflate flotation equipment.

b. Payoff - Prevention of parachute-related drownings using automatic release and improvement of pilot morale.

c. Risk - Environmental testing, hero and CAD qualification will be required. A high degree of reliability will be required of this device. The attainment of this goal presents only a moderate technical risk.

d. Applicable STO's - SL12-0-9; 12-G-16. High Priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Technical reports and tri-service coordination.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Survival and Rescue Equipment
Sub-Task Title: Rescue Locator System
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 May 1978
Performing Laboratory/Center: ACSTD, NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215/441-2189
Project Engineer: J. T. Micciche/T. Guttman
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective: To develop a downed airman locator system effective at any operational altitude.

b. Technical Approach: Several paths will be investigated for optimum results; i.e., laser reflector systems.

c. Goals: To expeditiously locate downed airmen without enemy awareness. The sensor-carrying aircraft could fly as high as 40,000 ft., cutting location time by 50% and increasing the number of men located in a given time by at least 40%.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem: Too long a time is required by today's methods for locating downed airmen on land or water. The urgency of locating the downed airman is heightened by the short survivability time in cold water and the hazard of capture on land.

b. Payoff: Safe and quick rescue of downed airmen.

c. Risk: Minimum risk is involved since the state of the art of equipments available or installable in USAF and/or Navy aircraft is sufficiently advanced to enable the rescuee to aid the searchers.

d. Applicable STO's: SL 12-F-1; SW 10-B-17. High Priority.

3. Program Coordination

Other Navy ☒ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

Tri-service coordination will be effected by NAVAIRDEVCEN.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Survival and Rescue Equipment
Sub-Task Title: All Weather Miniboat
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 May 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie; 215/441-2189
Project Engineer: J. T. Micciche/R. A. Zaffiri
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To determine the feasibility of supplementing the inherent thermal protection afforded by the insulative structure of miniboats.

b. Technical Approach - Design approaches will include the use of a closable/reclosable canopy, investigation of reflective heat sealable materials, the adaptation thereto of a one-man body-heating device (DAPS), and the vacuum packaging (with tear-strip opening) of this system. Thermal testing will be conducted to prove the design.

c. Goals - To provide the optimum balance between duration of low temperature exposure protection and minimum size and weight of the stowed, long-shelf-life miniboat package. To prevent exposure to rain, wind, spray and the wash of waves over the gunwales by completely enclosing a miniboat.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Military life rafts are excessively heavy and bulky. Their materials and their cemented seams deteriorate with age. Seam deterioration has enforced the practice of regular pressure testing which accelerates such deterioration. Constant-wear exposure protection has also been a long standing problem aggravated by the increasing demands on aircrewmen in the performance of their mission.

b. Payoff - The welded or heat-sealed miniboat is a lightweight, small, efficient flotation platform that should enjoy a long life with vacuum packaging. The primary payoff will be the optimum exposure protection available for survivors in this passive system and the potential increase in mission performance because of the reduction in bulk of constant-wear habiliments it offers as compared with life rafts. Another payoff is the shelter provided by such an insulated enclosure for survivors on land. The logistic payoff will be the reduction of maintenance effort.

c. Risk - Since the superiority of miniboat flotation and the DAPS heat source have already been proven, there appears to be no risk in the technical approach.

d. Applicable STO's - SL 12-D-9; 12-G-16. High Priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Technical Report and liaison with U. S. Air Force.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 62758N Task Area Title: Aircrew Survival and Rescue Equipment
Sub-Task Title: Seat-Back Restraint and Survival-EQuipment Stowage Package
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 May 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: R. J. Crosbie;215/441-2189
Project Engineer: J. T. Micciche/D. Naber; 215/441-2857/2512/2093/2848
Contributing Laboratory/Center: NWC, China Lake, CA
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 05/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To develop a unitary restraint and survival-equipment back-pack system for installation in VF/VA/VSTOL/VS ejection seats.

b. Technical Approach - Integrate a cushioned survival-equipment back-pack/restraint-interfacing system for ejection-seat occupants. The system, through which the aviator will be attached to the ejection seat, will be detached from the seat during parachute deployment to accomplish man-seat separation. It will incorporate an encapsulating raft for dry water entry, a DAPS heater and minor survival items secured within the packed raft. Items externally arranged both for prior access and post-ejection use will include a PRC-90 radio, all purpose cutting device, and disposable reserve-O_2 supply, manually switchable to the HGU-35/P helmet-mask assembly during inflight emergency, the O_2 bottle also accompanying the aviator during emergency ground departure. Tri-level restraint and parachute interfacing, secured to the seat structure and integral with the pack, shall include adjustable wrap-around wings for enclosing the aviator frontally, with provision for single point release for emergency departure on deck.

c. Goals - Divest the aviator from burdensome habiliments that fatigue him and reduce his flight-readiness time and provide multimodal restraint actuation and improved survival equipments to arrest the long-term degradation of aviator survival.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Naval Safety Center statistics indicate a long-term trend toward increased ejection fatalities, notably following high-Q and low-altitude/unfavorable-attitude ejections, the incidence of equipment malfunctions also being excessive, and the location of and lack of space for improved subsystems in RSSK's frequently being a critical factor barring development and use.

b. Payoff - Enhanced aviator ability to perform cockpit duties under combined stresses and maximized multi-mode survival protection throughout the spectrum of emergencies; net cost savings of $1.5M per aviator saved by improved system and equipment complement; unique adaptability to new ejection-seating technology being planned for maximized g-performance and combat effectiveness.

c. Risk - The task embodies extensive integration of equipments into a new configuration but appears to be well within the state of the arts generally.

d. Applicable STO's - SL-12-D-9; 12-D-10; 12-G-14; 12-G-16. High Priority.

3. Program Coordination Other Navy ☒ USMC ☒ Army ☐ USAF ☒ TriService ☐ Other _____

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape and Survival System
Sub-Task Title: Comp. Advanced Development Program (HESS)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. DeSimone(DPM), AV 441-2187
Project Engineer: J. T. Micciche
Contributing Laboratory/Center: NPTR, NOS, NSDRC
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To improve the survival opportunities of helicopter flight crews, troops-in-transport, and passengers. Combine and install a group of technical developments into individual aircraft via ECP (Engineering Change Proposal) packages.

b. Technical Approach - Invest R&D resources for the advanced development of hardware for experimental or operational testing. The following technologies are included: 1) Helicopter Flotation/Sink Rate Retardation; 2) Automatic/Explosive Separation of Hatches; 3) Underwater Breathing Devices; 4) Seat Installed Back Pack for Emergency Egress; 5) Up Direction Indicator; 6) Under Egress Training/ Simulator; 7) Under Egress Training/Film; 8) Inflatable Body/Head Restraint.

c. Goals - Increase personnel survival probability and reduce injury rate under survivable crash conditions by 25%.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - An estimated 25% of fatalities resulting from helicopter crashes are avoidable through a combination of improved crew protection and impact energy absorption, flotation and/or retarded rate of water immersion in an ocean crash, and through improved equipment capabilities facilitating escape from the aircraft after the crash.

Incorporation of all candidate improvements would exceed the limit of additional weight that might reasonably be added to existing aircraft. Additionally, ECP costs for all systems are potentially prohibitive. A coherent, systematic approach to selecting maximum payoff sub-systems or individual items for development and ultimately incorporating these into fleet aircraft is required.

b. Payoff - Reduced crew fatalities and the possibility for salvaging aircraft now completely destroyed or lost after a crash.

c. Risk - Without a unified program, the risk exists that few on-going developments will actually be included in existing fleet aircraft. ECP costs and weight/ performance penalties are potential risk areas.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other ____

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape and Survival System
Sub-Task Title: Helicopter Flotation /Sink Rate Retardation
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. De Simone (DPM) A.V. 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center: NSRDC
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - Provide for floating and/or slowing the rate of sinking of a helicopter after emergency landing or survivable crash in ocean conditions up to sea state 5.

b. Technical Approach - In-water stabilization of CH-46 helo will be explored through scale model evaluation, at NSRDC, Bethesda, MD. Results of stability testing will direct subsequent effort to either float or retard the sink rate of crashed helos.

c. Goals - Develop system to survive and function under conditions up to sea state 5. System will be aimed at CH-46 airframe, but is intended to be integrable into other Navy helos. Establishment of a controlled sink rate will be a goal of early modelling efforts.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - H-46 helicopters have sunk within 15 seconds of survivable crashes. Although capable of stable floatation, in-rushing water has trapped crewmen. Roll-over of the aircraft is probable, and sinking can occur in 15 seconds to 2 minutes.

b. Payoff - Time to escape a downed aircraft will result from use of a floatation/sink retardation system. The life-saving potential, for crew and troops-in-transport, is obvious.

c. Risk - Risk of the inherently unstable (in water) helicopter rolling into an inverted position is high. The potential exists for submerging passenger cabin. Additionally, failure of one or several deployable buoyancy modules may result in sinking, albeit at a reduced rate. Major Navy decision points exist after scale model testing in simulated sea state 5 conditions and after full scale prototype tests.

3. Program Coordination

Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape and Survival Systems
Sub-Task Title: Automatic/Explosive Separation of Hatches
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center: NOS
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Enhance escape capability from crashed helicopter through automatic escape hatch opening. System to function under conditions including complete water submergence of the aircraft.

b. Technical Approach - Locate shaped explosive charges into sections of the fuselage - free of fluid and electrical lines as well as heavy support structure. System to automatically initiate upon crash or water entry to sever fuselage and result in escape hatch(es). System to be ultimately mated to automatic escape lighting elements, with function initiated by same mechanisms.

c. Goals - Provide means for fast egress from crashed and/or sinking helicopter. Technology to be applied initially to CH-46 aircraft.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Jettisonable doors and escape hatches currently in the CH-46 required manual operation in order to open/separate. Due to water pressure operating against the man or on the door itself, and due to the turbulent circumstances associated with a sinking aircraft (e.g., impaired vision, disorientation of crew), manual operation of the doors is uncertain.

b. Payoff - Development of a system that can be retrofitted in any or all Naval helicopters. Fatalities associated with crashes into water especially will be reduced.

c. Risk - System may represent unacceptable weight and/or ECP cost penalty. Loss of inherent buoyancy must be avoided in circumstances where escape hatch opening is undesirable after a water landing for survivable crash. Physiological effect of underwater explosion has already been considered, and risk viewed as minimal.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape & Survival Systems
Sub-Task Title: Underwater Emergency Breathing (Helo)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone/DPM; AV 441-2187
Project Engineer: J. T. Micciche
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To provide helicopter crewmen and troops with a lightweight underwater breathing device for survival in a ditching emergency.

b. Technical Approach - Develop a man-mounted system comprised of a compressed air supply and breathing regulator, which will provide the survivor with sufficient air to egress and rise to the surface from a sinking helicopter.

c. Goals - To develop an acceptable emergency underwater breathing system which is less than 50 cu. in. in volume, less than 4 lb. in weight, and will provide a survivor with at least 3 min. of air at a heavy breathing rate.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - A high percentage of fatalities in helicopter accidents over water is drowning. This is primarily due to disorientation of the occupants in the underwater darkness, inrushing water forces, and inability to either reach or open escape hatches.

b. Payoff - It is estimated that better than 50% of drowning fatalities resulting from helicopter accidents could have been prevented with the development of an acceptable underwater breathing device.

c. Risk - Developing a system which will provide acceptable tradeoffs in weight and volume versus comfort and compatibility with personnel operational working requirements.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape & Survival System
Sub-Task Title: Seat Installed Back Pack for Emergency Egress
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN / ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM; AV 441-2187
Project Engineer: J. T. Micciche
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - To develop seat installed survival back pack, including an emergency underwater breathing device, integrated with the restraint system with single point quick release capability for emergency egress helo aircrewmen and troops.

b. Technical Approach - Determine system requirements, develop experimental prototypes of systems and/or components using proven technologies, and evaluate candidate systems through feasibility demonstrations, crash testing and systems analysis.

c. Goals - To reduce time required for helo aircrewman and troops to escape his aircraft during any emergency, including underwater, to less than 10 seconds.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Some of the more critical and time consuming tasks, a helo aircrewman/troop encounters during emergency egress from his aircraft include, his divestment from his seat/restraint system, location of his survival gear, and holding his breath when underwater.

b. Payoff - Increase the survivability of helo aircrewmen/troops during any emergency, including underwater, by minimizing the number of his pre-egress tasks.

c. Risk - The only recognized risk is a possible difficulty in reducing the size of the air-breather.

3. Program Coordination

Other Navy ☒ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 632037 Task Area Title: Helicopter Escape and Survival System
Sub-Task Title: Up Direction Indicator
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV-2187
Project Engineer: J. Micciche/G. Chisum
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective

To develop and test a prototype emergency direction indicator for helicopter passengers.

b. Technical Approaches

Assess candidate materials which can be incorporated into a personal direction indicator; design and develop a breadboard of the devices; incorporate HF, R&M and LS factors into the design; develop hardware specifications; construct and test a prototype of the device.

c. Goals

To develop an emergency direction indicator which will provide passengers and crew of helicopters which crash at sea with an easily used indication of the direction of the surface of the water. The device must be a piece of personal equipment which can be used with practically no chance of misinterpretation of the message conveyed. The device must not hamper normal movement in any way, and must be easily deployed and read under water.

2. Justification a. Problem b. Payoff c. Risk

a. Problem

When a helicopter crashes at sea, it usually sinks rapidly and may not only invert, but tumble so that the occupants become disoriented. That disorientation aggravates the normal disorientation which is experienced under water. Personnel who manage to find their way out of the submerged craft may drown due to delay in determining which direction to swim to reach the surface of the water.

b. Payoff

An up indicator will guide the occupants of an aircraft which crashes at sea and submerges to the surface of the water and reduce the risk of fatalities due to drowning.

c. Risk

The risk is small. A number of alternate materials are candidates for incorporation into such a device. The ultimate design must be assessed for adequacy and suitability.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape & Survival Systems
Sub-Task Title: Underwater Egress Training/Simulator
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. DeSimone, DPM; AV 441-2187
Project Engineer: J. T. Micciche/S. Winsko
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Enhance aircrew/troop survivability from a crash submerged helicopter through a systematic training/indoctrination program aimed at promoting skills in coping with the hazards associated with underwater emergencies and disorientation.

b. Technical Approach - Investigate current simulation programs used to train personnel for underwater emergencies and modify/extend their simulations or develop new simulations as required. Through simulation and post hoc data analysis, identify and define the most effective sequence of behavior in effecting timely underwater egress.

c. Goals - Establish and extend habits/skills to enhance aircrewman/troop survivability and learn/evaluate the effectiveness of current and projected helicopter escape and survival systems.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - The lack of experience in coping with the stresses associated with underwater emergencies, including disorientation, has been identified as a major cause for the high fatality rate of helo aircrewmen/troops following in-water emergency crashes.

b. Payoff - The proposed program will provide an increased probability of aircrewman/troop survival following an in-water helo crash.

c. Risk - The transfer of skills learned during simulation studies to real world emergency situations is largely dependent upon the validity of the simulation. The major risk in this program is therefore one of attaining a valid simulation.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape & Survival System
Sub-Task Title: Underwater Egress Training/Film
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. DeSimone, DPM; AV 441-2187
Project Engineer: J. T. Micciche/S. Winsko
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - Establish and enhance a set of effective coping skills in the helo aircrewman, using cinemagraphic/video techniques, to enable him to combat the effects of inrushing water flooding and disorientation, to increase the probability of his escape and survival from the helicopter following in-water crash.

b. Technical Approach - Using the latest cinemagraphic/video techniques applied to detailed simulation of underwater egress situations, effective sequences of behavior will be amplified and documented to compliment a full escape and survival training program.

c. Goals - Establish and expand behavior/skills to increase helicopter aircrew survival statistics and document/compliment existing survival training programs.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Visual and dynamic documentation of demonstrated successful escape/survival training is needed to complement escape/survival training and to improve the utility and worth of this specific non-technical training technique.

b. Payoff - The proposed program will enhance/compliment other escape and survival programs and will increase the survivability of aircrewmen/troops following an in-water helo crash.

. Risk - The range of simulated situations must approximate the real world situation, or maximal effectivenss of this technique may not be achieved in promoting helo-aircrewman/survivability following an in-water crash.

3. Program Coordination

Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and othe tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63203N Task Area Title: Helicopter Escape and Survival System
Sub-Task Title: Inflatable Body/Head Restraint
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center: NAVAIRTESCEN
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective. To develop an inflatable bodyhead restraint system for helicopter crewman.

b. Technical Approach. Develop an inflatable body head restraint system consisting of inflatable bags and a pyrotechnic inflator integrated into the shoulder harness assembly and activated by a remote crash sensor.

c. Goals. To develop a restraint system which will automatically and rapidly compensate for any slack in the passive restraint system thereby coupling the occupant to the restraint system and reducing injury due to high strap loads.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem. Current harness type restraint systems do not effectively restrain the occupant of the seat during a crash. The combination of restraint slack, elasticity and body compression allows the occupant to move downward and forward in the seat. When he moves sufficiently to be coupled to his restraining system high decelerative and strap loads are applied to his body as his velocity instantaneously decreases to the velocity of the seat. At the same time his head and neck hyperflux and begin to rotate rapidly forward until forcibly stopped.

b. Payoff. Increased crash protection by means of automatic pretensioning thereby reducing dynamic overshoot; reduces strap loading on the wearer & reduces rotation and whiplash induced trauma.

c. Risk. Definition of crash pulse to be seen by crash sensor and reliable operation of sensor.

3. Program Coordination

Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other ____

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Aircrew Protective Clothing and Devices (Mission-Oriented Equipment)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN / ACSTD
Technical Coordinator/Phone: D. DeSimone, DPM/441-2187
Project Engineer: N. Benson, A. Hellman
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

Objective - Development of equipment configurations for all aircrewmen of the Helicopter, Fighter/Attack and Multi-Engine Communities. The following programs are currently in development:

1. Integrated Helo Helmet (Helo)
2. HGU-27/P Pilot/Sonar Crew Helmet (Helo)
3. Multi-Raft DAPS with Blanket (Helo)
4. Thermal Cooling System (Helo)
5. Heat Sealed Multi Raft for Auto Raft System (Helo)
6. Integrated Protective System (F/A)
7. Fighter/Attack DAPS (F/A)
8. G-Valve (F/A)
9. Helmet Compatible Eyeglasses (F/A)
10. HGU-35/P Helmet (F/A)
11. Encapsulating Raft (F/A)
12. Mission Study Analysis (Multi-Engine)
13. Jacket with Flotation " "

Technical Approach - Determine each aircrewman's needs for successful accomplishment of his mission, with due regard for developing states of the art. Stressing commonality, wherever practicable, as well as R&M, develop appropriate systems to maximize crew performance. See individual program management summaries for appropriate details.

Goals - Provide constant-wear habilments maximizing safety and comfort and compatible with the unique flight duties of the respective aircrewmen.

2. Justification

a. Problem b. Payoff c. Risk

Problem - Equipments presently carried on the persons of helicopter aircrewmen and others have been adapted from the highly standardized, strictly functional habiliments (also obsolescent) worn by fighter pilots who are rigidly strapped into their seats. These are particularly unsuitable for helo personnel and especially so for such mobile personnel as vertrep crewmen, rescue swimmers etc. To perform their missions properly, they require equipments specifically designed for their duties.

Payoff - Improved safety, capability and efficiency of all aircrew personnel in performing their specialized duties.

Risk - Most, if not all, of the risks have been eliminated via exploratory developments.

3. Program Coordination

Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other

USAF and Army will be kept informed through the Flight Environment Working Group of the Tri-Service Life Support Steering Committee chartered by DDR&E.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing and Devices (Integrated Helmet-Helo)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187
Project Engineer: N. Benson/R. Routzahn
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/CrewEquipment & Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - Develop an integrated helmet system for the mobile helicopter aircrewman incorporating current advances in state-of-the-art helmet design.

b. Technical Approach - The system will provide a cordless communications link between the mobile aircrewman and a radio control. Other mobile crewmen in helicopter and on the ground or carrier will also be linked cordlessly through the radio control. The pilot/co-pilot will be linked to the radio control through the AIC (Aircraft Intercom) system. The system will also incorporate cooling to relieve thermal stress.

c. Goals - Increase helicopter aircrewman effectiveness 77% by providing a direct communications link between aircrewmen and crewmen located on the ground or on a carrier and by providing relief of heat stress; each without continuous umbilical connection to the aircraft.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - NAVAIRDEVCEN Report Nos. NADC-73003-40 and NADC-74215-40 document a study of the hazards and problems confronting helicopter aircrewmen. The report specifically concluded there is a need for a new headgear system for the mobile aircrewmen, with cooling capability and communications and without umbilical connection to the aircraft.

b. Payoff - More efficient completion of demanding work assignments and improved aircrew communications for mobile helicopter aircrewmen.

c. Risk - There are no foreseen risks at the present, since feasibility of communications and cooling concepts has been demonstrated.

3. Program Coordination

Other Navy ☒ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

Helo Desk (CH-46, CH-53). The Army and USAF will be kept informed.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing & Devices(HJU-27/P Pilot/Sonar Crew Helmet)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187
Project Engineer: N. Benson/R. Loewenstern
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. To develop a protective helmet designed for the specific requirements of the helo community and particularly the sonar operator.

b. Technical Approach - Design a helmet with optimum ambient-noise attenuation, improved signal discrimination and detection, improved comfort and fit, and increased peripheral vision. Test and evaluate the helmet and prepare appropriate documentation for procurement.

c. Goals - To improve the inflight effectiveness of the sonar operator.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - The helicopter crewman/sonarman now wears a helmet which offers poor thermal comfort, inadequate noise attenuation and insufficient peripheral vision.

b. Payoff - Improved in-flight performance of helicopter crewmen.

c. Risk - There are no technical risks associated with this development.

3. Program Coordination Other Navy ☒ USMC ☒ Army ☒ USAF ☐ TriService ☐ Other

Helo Desk (CH-46, CH-53). The Army and USAF will be kept informed.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Prot. Clot. & Dev. (Multi-place Life Raft w/DAPS (Down. Air. Pow. Source
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187
Project Engineer: N. Benson/J. Esposito; 441-2857/2512
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To provide a Downed Aircrewman Power Source (DAPS) for rafted aircrew survivor groups without adding any encumbrance to individual personnel during flight missions.

b. Technical Approach - Using technology developed for individual-size DAPS in conjunction with liquid-circulating undergarments, develop a similar system for use with multi-man crews.

c. Goals - Increase survival time to a day or more (within the constraints of the fuel supply) while providing continuous electrical power for survival radios.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Downed aircrewmen aboard multi-place life rafts in frigid waters require some anti-exposure protection. This protection is not currently provided by available thermal protective equipment. Lack of such equipment can result in death or permanent physiological damage to survivors.

b. Payoff - Protection of survivors from fatality or thermal disability throughout the interval required by SAR.

c. Risk - No substantial risk - the development is simply an extension of proven principles to a larger model.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

No direct participation with other services. The USAF will be kept informed of Navy efforts in this field in which it has shown little interest to date.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing & Devices (Thermal Cooling System Helo)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. DeSimone, DPM/441-2187
Project Engineer: N. Benson/S. Reeps
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide thermal comfort to seated & mobile crewmen of helicopters to offset the high heat buildup experienced in tropical zones of operation.

Technical Approach - A thermal cooling system, comprised of a coolant generator/pump and a variety of coolant distributing garments and which is automatically controlled to satisfy the need for cooling , will initially be developed for the seated Helo crewman. Modifications of this system will then be made to satisfy the needs for the mobile Helo crewman.

Goals - To improve the effectiveness of helicopter missions in high ambient temperatures.

2. Justification a. Problem b. Payoff c. Risk

Problem - The efficiency of helicopter aircrews operating in high temperature areas is greatly reduced, thereby jeopardizing the success of the mission.

Payoff - Improved mission effectiveness.

Risk - The only technical risk (which is not significant) is the problem of reducing the size of coolant generators for adaptability to aircraft use.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other _____

The Army and the USAF will be kept informed through the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems

Sub-Task Title: Aircrew Protective Clothing & Devices (Heat Sealed Multi-Raft)

Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978

Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD

Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187

Project Engineer: N. Benson/E. Colacicco

Contributing Laboratory/Center:

Cognizant SYSCOM Code: AIR-340B

CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - Develop a multi-place life raft using heat sealingtechnology in place of the current method of cementing for seaming.

b. Technical Approach - Utilize the newer heat sealing coated fabrics in place of neoprene fabrics specifically designed for use in conjunction with the heat sealing technique.

c. Goals - Reduce the cost and increase the reliability and longevity of multi-place life rafts by approximately 50%.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Current methods of manufacturing multi-place life rafts employ taping and cementing techniques for seaming. This results in extensive maintenance requirements, reduced reliability, and increased bulk for packaging.

b. Payoff - Lower initial acquisition cost, reduced maintenance cost and increased reliability of multi-place life rafts.

c. Tisk - There are no technical risks associated with this development.

3. Program Coordination

Other Navy ☒ USMC ☒ Army ☒ USAF ☐ TriService ☒ Other

The Army and USAF will be kept informed of this development through the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing & Devices (Integrated Protective System)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2167
Project Engineer: N. Benson/W. Castine
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To develop a personal integrated protective system capable of providing restraint, anti-g protection, anti-exposure protection, supplemental thermal control, flotation, decompression protection, emergency egress, and a minimum of restriction to the aircrewman during normal flight.

b. Technical Approach - Following a conceptual study, the advanced development and fabrication of two functional non-flyable prototypes will be initiated. An advanced ejection seat will be modified to integrate with the prototypes.

c. Goals - Increase fighter/attack aircrewman's effectiveness by minimizing encumbrances, maximizing protection during ACM performance and in the event of a ditching accident while providing a comfortable ready room configuration.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Navy fighter/attack pilots are presently equipped with a collection of non-integrated protective clothing which encumber him and markedly reduce his capabilities in the ACM (Air Combat Maneuver) environment.

b. Payoff - Fighter/attack pilots will be provided more protection with less encumbrances which will increase their performance during ACM while also providing an increased capability for survival in the event of a ditching accident.

c. Risk - There are no foreseen risks of this advanced development program.

3. Program Coordination Other Navy ☒ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

The Army and USAF will be kept informed through the Flight Environment Working Group of the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing & Devices (Fighter/Attack DAPS)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187
Project Engineer: N. Benson/J. Esposito
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. To provide the downed crewman of an ejection seat type aircraft with supplementary thermal protection above that which is provided him by his flight clothing and raft.

b. Technical Approach - Develop a heat producing unit and garment system, Downed Aircrewman Power Source (DAPS), which would permit circulation of heated fluid over the body surface of the survivor while he is afloat and awaiting rescue.

c. Goals - To provide supplementary thermal protection to downed survivors of high performance aircraft.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Downed survivors of overwater ejections now rely on anti-exposure clothing for their protection against the hazards of cold, and the resultant lowering of body temperatures. Protective clothing of this nature is bulky and cumbersome thus compromising in flight performance.

b. Payoff - Increased protection against cold exposure and improved inflight effectiveness.

c. Risk - The technical risks are minimal; the main concern will be with scaling down design and integrating the system with other personal flight equipment.

3. Program Coordination

Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other

The Army and the USAF will be kept informed through the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing and Devices (Anti-G Valve System)
Program Status: On-going ☐ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. De Simone, DPM/441-2187
Project Engineer: N. Benson/M. Lamb
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To develop an Anti-g valve system capable of providing the VF/VA aircrewman with the maximum protection possible from his anti-G suit to the debilitating effects of high G.

Technical Approach - Data obtained during studies on three separate anti-G valve systems now in various stages of development, will be examined to determine the correct technical approach. Development will be initiated on that valve which is the most efficient with respect to protection, reliability and cost.

Goals - Increase fighter/attack aircrewman's effectiveness by increasing his ability to utilize the full potential of his aircraft's maneuverability.

2. Justification a. Problem b. Payoff c. Risk

Problem - Anti-g valves currently in use in the fleet are incapable of reacting quickly enough to protect against the high rates of acceleration forces imposed by the high performance aircraft. In addition, the valves have a high failure rate due to corrosion and other high maintenance factors.

Payoff - The high G maneuvering capability of current and projected VF/VA aircraft will be more effectively used by increasing the pilots G protection through the use of a highly efficient anti-G valve system.

Risk - The technical risk of this development has been minimized because the feasibility of the various candidate valves has been proven during exploratory development programs.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other _____

The Army and USAF will be kept informed through the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing & Devices (Helmet Compatible Eyeglasses)
Program Status: On-going ☐ Proposed ☐ Planned ☑ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187
Project Engineer: N. Benson/J. Lewyckyj
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - To provide corrective and/or sunglare protective eyeglasses to the Fleet that is compatible with currently used and proposed low profile protective helmet systems.

b. Technical Approach - Conduct a study of facial/helmet contour relationships to determine clearances between the eye and the visor in the visor-down condition of the helmet and design eyeglasses that are compatible with helmet constraints.

c. Goals - To provide eyeglasses (corrective, clear, or tinted) for those wearing single lens helmets and needing sun glare protection and/or optical correction, which will not impede the smooth up and down movement of his visor nor interfere with his hearing ability.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Protective helmets currently being developed have been reduced in size, weight, and contour and because of the closeness of fit to the face and because a one visor (clear) approach is being taken there is need to provide sun glare protection and/or optical correction by means of supplementary eyeglasses.

b. Payoff - Successful completion of this development will permit the use of reduced helmet contour designs, and allow easier pilot head maneuverability for those aircrewmen required to wear eyeglasses for optical correction and/or sunglare protection.

c. Technical risk in this program is considered to be minimal.

3. Program Coordination

Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other

The Army and USAF will be kept informed of this development through the Flight Environment Working Group of the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing and Devices (HGU-35/P Helmet)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. DeSimone, DPM/441-2187
Project Engineer: N. Benson/J. Castine
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - Develop a low profile, light-weight, form fit, buffet, head protection helmet with integrated oxygen and communications subsystems for the VF/VA aircrewman.

Technical Approach - The HGU-35/P design features KEVLAR laminate/honeycomb reinforced lightweight and high strength shell, logistically supportable form-fit liner, rear entry oxygen hose, state-of-the-art communications components and unobstructed visibility.

Goals - Improved aircrew mission performance by the development and acquisition of an integrated helmet system which offers optimum head movement, stability and visibility, and is lightweight.

2. Justification a. Problem b. Payoff c. Risk

Problem - The APH-6 helmet/A-13A oxygen mask combination severly compromises VF/VA aircrew performance due to its weight, bulk, misplaced center of gravity and instability during high "g" ACM.

Payoff - The HGU-35/P system will offer increased aircrew head mobility, unobstructed visibility and minimized aircrew fatigue.

Risk - None. Entirely within the state-of-the-art.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other _____

This program is being coordinated with the Life Support SPO at Wright-Patterson AFB.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing & Devices (Encapsulating Life Raft)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187
Project Engineer: N. Benson/S. Reeps/441-2857/2512
Contributing Laboratory/Center: NPTR/OPTEVFOR
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To provide the aircrewman with a flotation platform that will eliminate the sequence of water entry followed by raft boarding, thus greatly increasing the chance of survival.

b. Technical Approach - Develop a life raft which will encapsulate the aircrewman during parachute decent and provide face-up, dry water entry even though he may be injured.

c. Goals - To eliminate thermal shock of cold water entry and to keep clothing dry.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Many naval missions are flown over cold water. A downed aircrewman exposed to such an environment can suffer shock and/or hypothermia upon water entry, with severely adverse effect upon his time of survival.

b. Payoff - This raft, in conjunction with the Downed Aircrewman Power Source (DAPS) and the liquid-loop undergarment, which were designed for use therewith, will extend survivability somewhat beyond the limits of the fuel provided therewith or to the duration of the SAR. It will substantially eliminate hypothermia and drowning as causes of ejection fatalities over water.

c. Risks - The raft must be designed to guarantee face up touchdown and safe touchdown even if not fully inflated at water entry.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other ____

The USAF will be kept informed of Navy efforts in this field in which it has shown only slight interest to date.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing and Devices (Mission Study Analysis)
Program Status: On-going ☐ Proposed ☐ Planned ☑ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. DeSimone, DPM/441-2187
Project Engineer: N. Benson/S. Winsko
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To determine the specific needs of and the protection required for the Multi-Engine aircraft aircrewman.

Technical Approach - Visits to various squadrons employing multi-engine aircraft will be undertaken to study the various missions and to determine the stresses imposed on, and the protective equipment requirements for the aircrewmen in the performance of these missions.

Goals - Provide constant wear equipment which is safe, comfortable and compatible with the unique flight duties of the multi-engine aircrewmen.

2. Justification a. Problem b. Payoff c. Risk

Problem - Equipment presently carried on the persons of multi-engine aircraft aircrewmen has been adapted from that worn by other aircrewmen. These sometimes prove to be unsuitable to the multi-engine aircrewmen who require equipment specifically designed for them to perform their missions.

Payoff - Far greater safety, capability and efficiency of all aircrew personnel in performing their specialized duties.

Risk - Most, if not all, of the risks have been eliminated by exploratory developments.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☐ USAF ☒ TriService ☒ Other

The Army and USAF will be kept informed through the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Protective Clothing and Devices (Jacket with Flotation)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. DeSimone, DPM/441-2187
Project Engineer: N. Benson/R. Zaffiri
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide aircrewmen, faced with the possibility of cold water exposure, protection by means of a constant wear inflatable garment which imposes a negligible degree of discomfort during the hours of inflight wear.

Technical Approach - Develop an abbreviated inflatable body garment that can be constantly worn, and quickly inflated by the wearer in a cold water immersion situation, and which will provide insulation and thermal protection.

Goals - To save the lives of aircrewmen exposed to the hazards of cold water immersion.

2. Justification a. Problem b. Payoff c. Risk

Problem - Insulation clothing for exposure protection of aircrewmen is usually cumbersome to wear during the inflight mode and reduces inflight performance. Many crewmen elect not to wear some of this required clothing with the risk of being insufficiently protected in the event of immersion in cold water.

Payoff - Increase chances of aircrewmen survivability in cold water.

Risk - No technical risks anticipated.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☒ Other

The Army and USAF will be kept informed through the Tri-Service Life Support Steering Committee.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Maximum Performance Ejection Seat (MPES)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: M. Schulman, J. Tyburski 2523, 2535
Contributing Laboratory/Center: NWC, NPTR, NWESA, NOS
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective-Develop a lightweight escape system with superior performance and expanded operational envelope, with minimized maintenance requirements, maximized reliability and an overall advancement in the state of the art of escape-system technology.

b. Technical Approach - New technologies proven feasible in the areas of new lightweight materials for seat structure, propulsion, vertical-seeking steering and stabilizing systems, micro-processor control timing/sequencing, positioning/restraint, high-Q protection, aerodynamic stabilization/recovery and survival systems will be integrated together into a complete escape system.

c. Goals - Safe ejection down to as low as 50 ft. above terrain from fully inverted aircraft, with lesser roll angles counterbalancing sink rates.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Despite the introduction of 0-0 ejection in the late 1960's, Naval Safety Center Statistics indicate decreasing ejection survivability, particularly in ejections at low altitudes and unfavorable altitudes, seat/chute system malfunctions being another important contributing factor.

b. Payoff - Successful completion of this program will enable reduction of injuries/fatalities sustained by aircrewmen with a potential yearly saving of 15-20 million per year, based on an aircrew replacement cost of 1.5M per aviator fatality.

c. Risk - All development areas have been proven feasible or are within current or near term state-of-the-art and will impose little or no risk.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other ____

USAF and Army will be kept informed through the Flight Environment Working Group of the Tri-Service Life Support Steering Committee chartered by DDR&E.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Advanced Recovery Systems
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. DeSimone, DPM; AV 441-2187
Project Engineer: G. Drew (NPTR)
Contributing Laboratory/Center: National Parachute Test Range (NPTR)
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - To provide an ejecting aircrewman with an aerodynamic decelerator having a wide range of reliable performance, provisions for gliding flight and maneuverability, and packaged in a hermetically sealed vacuum container for extended service in the operational environment.

b. Technical Approach - The proven technologies of RAM AIR Inflated gliding parachutes, multi-stage drogue stabilization subsystems, and sealed parachute containers will be combined into an advanced development program. Prototypes of systems/components will be designed, manufactured and tested.

c. Goals - Provide safe escape and steerable capability to an ejecting aircrewmen over a wide range of speed and altitude, increase the lift/drag ratio of the recovery system from 0.1 to 1.0 for low altitude ejections, reduce high Q forces by 50%, reduce maintenance by 95%, and increase service life by 100%.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Current recovery systems produce injuries to aircrew during high speed drogue deployment, are marginally acceptable for low altitude, zero speed parachute extraction/deployment, do not provide long range gliding or steering capability, and require periodic repacking which contribute to high life-cycle costs and represent negative opportunities for misrigging/packing errors/and reduced reliability.

b. Payoff - Provide ejecting aircrewman with an increased evasion capability which will reduce the possibility of his being captured, injured, or drowned. Injuries resulting during hi Q ejections will be reduced while opportunities for safe ejection at low altitude, low speed, will be increased. Also, the reliability of the recovery system will be increased at a reduced life-cycle cost.

c. Risk - The probability of successful completion and fleet use of this system is 95%.

3. Program Coordination

Other Navy ☒ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

Progress of this advanced development effort will be regularly reported at symposiums/meetings.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63217N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Lightweight Environmental Control System (ROVAC)
Program Status: On-going ☐ Proposed ☑ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: J. McNamara/E. Boscola
Contributing Laboratory/Center: AFFDL/Wright-Patterson AFB
Cognizant SYSCOM Code: AIR-430B
CNM Product Area No./Title: 16/Naval Vehicles

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide an improved, easily maintainable, low-cost, high-capacity aircraft environmental cooling systems (ECS) to meet expanding demand with a major aircraft weight reduction potential and a stable temperature and pressure characteristics for improving crew environment and avionics reliability.

b. Approach: Develop a closed-loop ECS having a positive-displacement air-cycle machine (ROVAC) and using fuel as the primary heat sink. Integrate with self-start system and advanced flight control systems.

c. Goals: Reduce gross aircraft weight penalty by 4000# in a typical 62,000# GTOW aircraft. Increase aircraft thrust by 2% and reduce fire hazard via recirculation takeoff. Increase cooling capacity by one-third. Increase reliability of cooling system and avionics systems. Reduce engine bleed air consumption by 85-95%. Eliminate ram-air intake drag.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Current ECS open-loop systems consume too much engine bleed air. Bleed air supply consumes power and is a fire hazard, as well as being subject to engine operating transients. Bleed air systems have a high weight/output ratio and their high temperatures require costly materials. The use of ram air for cooling adds to aircraft drag.

b. Payoff: A reduction of the weight penalty imposed by present systems of 25-50%. Extra cooling capacity (1/3) for avionics systems growth. Reduction of avionics maintenance work.

c. Risk: Introduction of the closed-loop system necessarily involves some technological risks. The low-speed character of the Advanced ECS/ROVAC is expected to moderate the R&M problems.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other _____

Navy supporting AF effort in the Advanced ECS program (AFFDL, WPAFB). AFFDL, WPAFB was the lead laboratory in the 6.2 development effort.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 63216N Task Area Title: Airborne Life Support Systems
Sub-Task Title: High Acceleration Cockpit
Program Status: On-going ☒ Proposed ☒ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. DeSimone (215) 441-2187
Project Engineer: R. Crosbie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To increase aircrew G-tolerance to match peak and sustained G-force capability of existing and emerging VA/VF aircraft. To boost pilot performance for ACM/missile evasion.

b. Approach: Utilizing available and emerging technology (new anti-g valves, knee lift, body inclination, new technology controls/displays), cockpit systems in existing aircraft will be reconfigured to provide maximum G-tolerance for the pilot.

c. Goals: Improvement of task performance and moderation of straining and fatigue during exposure to +8G sustained and +10G peak in simulations representing prolonged and repeated ACM encounters and missile evasion tactics.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Aircrew performance during exposure to high acceleration is degraded by failure of vision and cognitive processes caused by inability of circulatory system to supply oxygen to the brain. High G-forces inhibit pilot's ability to operate controls and overwhelming fatigue is hastened by muscular straining. The probability of loss of combat effectiveness, followed by loss of aircraft and crew, is gravely augmented.

b. Payoff: Increased mission effectiveness against ground and air targets and in combat survivability of aircraft and crew.

c. Risk: Retrofit of existing cockpits may be costly, particularly if it becomes necessary to reconfigure instrument panels for leg clearance. Retrofit plans for one aircraft may not be adaptable to another.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Navy assisting USAF HAC development with data runs and centrifuge improvement program to prepare for USAF prototype tests in FY-80.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Replacement Ejection Seat in A-7,A-4,S-3 A/C
Sub-Task Title: ESCAPAC Replacement Program
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: Naval Air Development Center/ ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: Alan Cantor/C. Woodward
Contributing Laboratory/Center: NATC, NWESA, NSWC, NPTR, NWC, NOS, NARF Pens.
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title:

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To replace the ESCAPAC ejection seat in the T/A-7, T/A-4, and S-3 aircraft with a modern ejection seat which will provide better R&M and life-saving potential.

b. Technical Approach: Through a competitive process, select a replacement ejection seat for the ESCAPAC in the T/A-7, T/A-4 and S-3A aircraft.

c. Goals: Deliver the first production seats into the fleet within 32 months of the start of the program.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: An in-depth review by CNO of the current escape system in the T/A-7, T/A-4, and S-3A aircraft has shown that the current design now in the operating fleet is not up to the standards required for today's aircraft. Deficiencies in such areas as stabilization, seat performance and recovery and restraint subsystems have resulted in numerous injuries/fatalities.

b. Payoff: Payoff will be realized in the saving of crewmember lives with a consequent reduction in retraining and replacement costs. Reliability and maintainability of the system will be greatly improved, resulting in a reduction in life-cycle costs.

c. Risk: The main risk is meeting the compressed schedule for the production seats.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

Program is being fully coordinated within the Navy and USAF. The Air Force ACES II ejection seat system is a candidate seat under consideration.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Comp. Engineering Development Program (HAS)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center: NPTR, NOS, NSDRC
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

Objective - To improve the survival opportunities of helicopter flight crews, troops-in-transport, and passengers. Combine and install a group of technical developments into individual aircraft via ECP (Engineering Change Proposal) packages.

Technical Approach - Invest R&D resources for the engineering development for systems recommended for Service use but not yet approved for procurement and operation. The following systems are included:

1. Crashworthy Seating
2. Automatically Expelled Life Rafts
3. Helo Pilot/Copilot Survival System
4. Mobile/Vert. Rep. Crewman Survival System
5. Passenger/Troop Survival System
6. Rescue Crewman Configuration System
7. Emergency Hatch Lighting System
8. Crashworthy Fuel Cells
9. System Engineering Master Plan

Goals - Increase personnel survival probability and reduce injury rate under survivable crash conditions by 25%.

2. Justification

a. Problem b. Payoff c. Risk

Problem - An estimated 25% of fatalities resulting from helicopter crashes are avoidable through a combination of improved crew protection and impact energy absorption, flotation and/or retarded rate of water immersion in an ocean crash, and through improved equipment capabilities facilitating escape from the aircraft after the crash.

Incorporation of all candidate improvements would exceed the limit of additional weight that might reasonably be added to existing aircraft. Additionally, ECP costs for all systems are potentially prohibitive. A coherent, systematic approach to selecting maximum payoff sub-systems or individual items for development and ultimately incorporating these into fleet aircraft is required.

Payoff - Reduced crew fatalities and the possibility for salvaging aircraft now completely destroyed or lost after a crash.

Risk - Without a unified program, the risk exists that few on-going developments will actually be included in existing fleet aircraft. ECP costs and weight/performance penalties are potential risk areas.

3. Program Coordination

Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other ____

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Crashworthy Seating
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Provide helicopter crashworthy seating (armored, unarmored, troop, etc.) for Navy helicopters. Enhance survivability of personnel in air crashes through impact protection alone (estimated 2.3% of fatalities).

b. Technical Approach - Design and development of seats using proven shock absorption and structural design techniques; i.e., as demonstrated by the armored crewman seat now in production and being installed in CH-46 aircraft. To ultimately integrate seats demonstrated in engineering development into fleet aircraft via ECP.

c. Goals - Retrofit seats to existing Navy helicopters where possible. Demonstrate family of seats applicable to new aircraft developments; e.g., LAMPS MK III.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - 25% of helicopter crashes are estimated to be survivable given crash impact protection and fire suppression/protection and water floatation. Crashworthiness alone, without additional systems, may elminate over 2% of fatalities.

b. Payoff - Reduction in crew and troop/passenger injuries and fatalities.

c. Risk - Aircraft in-service may have insufficient structure to permit retrofit of seats. Seat and fittings may represent unacceptable weight penalties and ECP costs.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Automatically Expelled Life Rafts
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center: NAVAIRTESCEN
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Provide Navy helicopters with automatically deployed life rafts. Multiplace rafts will be able to inflate upon survivable crash and sinking of the aircraft, remaining on the surface should the aircraft submerge completely.

b. Technical Approach - Store raft(s) in external fuselage blisters or pods, aerodynamically designed to minimize drag effects pod. Separation or opening to occur on raft inflation. Inflation will be triggered by a combination of stopping of rotor blade spin and sensing of water entry. A manual overide capability will also exist.

c. Goals - Produce a low-weight system which will reliably deploy multiplace raft(s) after a crash in water. Because of the problem of safe egress from a floundering or sinking aircraft, this effort seeks to relieve the crew or troops-in-transport of having to manually deploy the internally stowed rafts.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - A percentage of deaths attributable to drowning after Navy helicopter water accidents are caused by disorientation, unfamiliarity with underwater escape procedures, incapacitating injuries, and lack of personnel floatation devices. All these factors are compounded or aggrivated by the requirement to manually remove a raft from internal stowage and deploy.

b. Payoff - It is estimated that 6.5% of occupant fatalities could be prevented through provision of emergency floatation alone.

c. Risk - Drag download and weight penalties on the aircraft. Developments to date favor removal of personal survival kits from standard raft kit, with an associated 30% weight and volume saving. Engineering studies to date, however, indicate that there is no further technical risk in this program.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Helo Pilot/Co-Pilot Survival System
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/AV 441-2187
Project Engineer: J. T. Micciche/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To develop an integrated survival system for Helo aircrewmen at fixed stations, particularly the Pilot and Co-Pilot.

b. Technical Approach - To develop a survival system by integrating existing survival systems and/or recent developments into a satisfactory system consistent with inflight duties, SAR requirements and equipment usage data.

c. Goals - To develop a satisfactory survival system for the Helo pilot/co-pilot that will have high inflight compatibility and acceptance.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - The current Pilot configuration is heavy, bulky and restrictive and is not compatible with aircrew body armor.

b. Payoff - The proposed system will improve inflight performance and safety while yielding other benefits including improved life cycle costs.

c. Risk - All technology is developed so there is no significant risk.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Mobile/Vert. Rep. Crewman Survival System
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM; AV 441-2187
Project Engineer: J. T. Micciche/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/CrewEquipment Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To develop a constant, wear mission specific Survival System for the Helo Mobile Crewman.

b. Technical Approach - Develop a life preserver, lift capability and survival equipment stowage for the Helo Mobile crewman while considering SAR data, equipment usage and inflight duties.

c. Goals - To develop a satisfactory survival system that will be fully compatible with the duties of the Mobile Crewman, e.g., Vert. Rep., Cargo Crewman, Mine Counter Measures Crewman, etc.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Currently, the Helo aircrewmen whose duties require him to be mobile, wear the standard Navy configuration. This configuration is not compatible with nis special duties since it restricts body movement and obstructs the frontal area.

b. Payoff - The proposed system will enhance the mission effectiveness and survivability of the Helo mobile crewman and have a projected initial and life cycle cost savings.

c. Risk - All technology is developed so there is no significant risk.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Passenger/Troop Survival System
Program Status: On-going ☐ Proposed ☐ Planned ☑ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM; AV 441-2187
Project Engineer: J. T. Micciche/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-340B
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To develop a survival system for use by Helicopter passengers/troops.

b. Technical Approach - To determine the passenger/troop projected needs for survival and incorporate this criteria into a lightweight, easily maintainable system.

c. Goals - To provide an easily maintainable survival system that will satisfy the needs of a passenger/troop during an emergency situation. The system will be compatible with all current/proposed aircrew configurations and will not require special rigging, attachments, etc. for donning.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - The current survival system for use by a Helo passenger/troop is not easily donned and requires removal of helmet before the preserver can be inflated.

b. Payoff - Helicopter passengers/troops will have an increased chance of survival during an emergency situation. Also the Navy will realize a cost savings with the new system because of the lower unit cost, lower maintenance costs and longer life.

c. All technology for this program has previously been developed, hence only minor risks exist.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Rescue Crewman Configuration System
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM; AV 441-2187
Project Engineer: J. T. Micciche/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To develop a survival system for the unique mission of the Helicopter Rescue Crewman.

b. Technical Approach: Develop an integrated system that will fulfill the needs of the Helicopter Rescue Crewman and serve as a survival system should he become the victim of a mishap.

c. Goals - To provide a complete operational survival system that will be easily and quickly donned and provide excellent body freedom for the in-water duties of the Rescue Crewman.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Past efforts in standardizing Rescue Crewman equipment have been in the form of Aircrew System Changes, however, only a totally new system can eliminate all the problems of the current one.

b. Payoff - The Rescue Swimmer System will have a lower unit cost, be easier to use and maintain, and be standardized.

c. Risk - No significant risk. All technologies have been previously developed.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Emergency Hatch Lighting System
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective. To develop and test a prototype emergency hatch lighting system for passenger carrying helicopters.

b. Technical Approach. Develop a hatch lighting package consisting of a self contained, battery operated, power supply, electroluminescent light strips and a switching unit.

c. Goals. To develop an emergency hatch lighting system which will provide assistance to the occupants of the cabin of a helicopter in locating emergency exits in the helicopter following a accident in which the helicopter sinks.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem. When a helicopter crashes at sea it usually sinks in a matter of seconds. In addition to sinking, the helicopter usually becomes inverted. The occupants become disoriented and cannot find the exits in the murky water. As a result there are a high number of fatalities due to drowning.

b. Payoff. Lighted exit hatches will guide the occupants out of the helicopter and reduce the fatalities due to drowning.

c. Risk. Reliability of lighting system must demonstrated. Lighting color and intensity must be established to assure adequate visibility under adverse conditions.

3. Program Coordination

Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: Crashworthy Fuel Cells
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Reduce the probability of fuel explosion and/or fire in the event of a crash or a projectile strike on internal fuel cells of the helicopter.

b. Technical Approach - Integrate proven crashworthy or fire suppressing systems into Navy helicopters, where possible. Of first interest are those aircraft which frequently operate overland in troop delivery; e.g. H-46 and H-53. Candidate systems would include, but not be limited to, a nitrogen gas injection system and separable self sealing fittings.

c. Goals - Make survivable those helicopter crashes which do not immediately result in fatalities but explode or burn immediately after impact.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Up to 8% of fatalities occurring as a result of helicopter crashes are attributable to injury at impact followed by fire. Even where over-water operations may be thought to yield an inherent fire suppressant (the water itself), the number of Navy inventory aircraft operating over land is high. Marine assault forces, utilizing CH-46 and -53 aircraft, are an example.

b. Payoff - Reduce fatalities (the 8% referred to) and potentially salvage-able wrecks. That is, the aircraft may survive if not burned as a result of crash.

c. Risk - Substantial ECP costs and weight penalties. Fire suppression itself may prove questionable in older aircraft requiring extensive retrofit to create fuel cells.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Helicopter Aircrew Survivability
Sub-Task Title: System Engineering Master Plan
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: J. Micciche
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description — a. Objective — b. Technical Approach — c. Goals

a. Objective. To develop a Helicopter Aircrew Survivability Enhancement Program (HASEP) Master Plan/

b. Technical Approach. Compile and catalogue helicopter accident data regarding types of helicopters, cause and effect, and survivability potential. Correlate this data with on going and planned programs for survivability enhancement and identity trade offs and/or other technology areas requiring development effort. This study will include personal equipment as well as airframe hardware.

c. Goal. To provide a plan for the orderly development and integration of aircrew survivability technology into existing and/or planned helicopters. The plan will identify the end product to be achieved, i.e., hardware integrated into existing vehicles or design specifications for survival components or systems to be integrated into and identified helicopter series.

2. Justification — a. Problem — b. Payoff — c. Risk

a. Problem. A large percentage of helicopter accidents result in serious injuries and/or fatalities. There are several programs planned or in being to develop technology to enhance aircrew survivability. Some of these programs are interrelated, some may be competitive approaches and some are independent. A comprehensive program plan must be developed & implemented to assure that the technologies are integrated efficiently and competing technologies are brought to a level where meaningful tradeoff studies can be conducted and the most cost effective system selected.

b. Payoff. Effective use of limited R&D funding to develop technology for survivability enhancement.

c. Risk. None.

3. Program Coordination — Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

Information is disseminated through scheduled and other tri-service coordination conferences, meetings, working parties, and by issuance of technical reports to the appropriate cognizant DOD agencies.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Automatic Life Vest Inflation Actuator
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Aug 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: E. Boscola, 441-2857, J. Lewyckyj, 441-2861/2092
Contributing Laboratory/Center: NOS, Indian Head, MD, and NSWC, Dahlgren, VA
Cognizant SYSCOM Code: AIR-5311
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - To provide aircrewmen who have ejected over water with automatic life-vest-inflation actuators that are sensitive to post-descent immersion in water but resistant to premature actuation.

b. Technical Approach - Develop, test and evaluate an add-on device which, when immersed in water, will automatically activate a standard CO_2 cylinder and inflate the life preserver.

c. Goals - To prevent post-ejection drowning of naval aviators.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - Since aviators, who eject from high-performance aircraft are disoriented by ejection and sometimes injured thereby, they often cannot find or operate the manual inflation toggles on the LPA-2 and LPU-21/P life preserver assemblies, with drowning as the consequence.

b. Payoff - Reduction of the incidence of ejection fatalities and restoration to duty of those saved from drowning. Cost saving to the Navy of over $1.5M per fatality prevention.

c. Risk - Entirely within the state of the art.

3. Program Coordination

Other Navy ☐ USMC ☒ Army ☐ USAF ☐ TriService ☒ Other USAF

The USAF will be kept informed of the progress of this effort through personal communications.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: On-Board Oxygen Generation System (Molecular Sieve)
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Aug 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: E. Boscola/M. Lamb, 441-2857-2512
Contributing Laboratory/Center: PACMISTESTCEN, NAVAIRTESTCEN
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment & Life Support

1. Program Description — a. Objective — b. Technical Approach — c. Goals

a. Objective - To eliminate hazardous and logistically burdensome LOX installations on ships and temporary forward bases by generating breathing oxygen aboard aircraft.

b. Technical Approach - Complete comparative development of open-loop oxygen generators for separation of oxygen from aircraft-engine bleed air applying the molecular sieve concept of absorption-desorption of 95% O_2.

c. Goals - Reduce support-personnel requirements by 60-70% as well as demands upon ship spaces; increase R&M via module replacement; achieve 1000-hour maintenance interval, 15-hour servicing interval, and 5000-hour MTBF.

2. Justification — a. Problem — b. Payoff — c. Risk

a. Problem - Logistics, maintenance problems and safety hazards associated with LOX supply systems are severe and are a continuing threat to the effectiveness of aircraft carriers, their aircraft and aircraft operating from shore and remote bases. Forty per cent of LOX is lost during transfer, storage and filling operations. Contamination of entire LOX supplies at remote bases occurs at least twice a year and shore-base and carrier-base fires have been directly attributable to the spillage of LOX, causing loss of lives and equipment.

b. Payoff - Enablement of fixed-wing aircraft operations from small ships and temporary bases, a particular prerequisite for VSTOL, and major reduction of personnel demands in support of other VF/VA aircraft. Elimination of 30 ton/ 2300 sq ft support requirement. Annual cost savings of $45M. Elimination of LOX-installation fire hazard and casualty vulnerability.

c. Risk - Magnitude of aircraft weight tradeoffs and demands on aircraft resources. Developments to date have demonstrated major reductions to values that now appear acceptable.

3. Program Coordination — Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other ____

USAF and Army will be kept informed through the Flight Environment Working Group of the Tri-Service Life Support Steering Committee chartered by DDR&E.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: HGU-35/P Integrated Helmet/Oxygen/Communications System
Program Status: On-going ☐ Proposed ☐ Planned ☐ Date: 1 Aug 1978
Performing Laboratory/Center: Naval Air Development Center/ACSTD
Technical Coordinator/Phone: D. De Simone 6002 AV-441-2187
Project Engineer: E. Boscola/J. Castine
Contributing Laboratory/Center: Pacific Missile Test Center
Cognizant SYSCOM Code: AIR-0531
CNM Product Area No./Title:

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - Development of an integrated helmet oxygen communications system designed to enhance aircrew performance in high performance aircraft.

b. Technical Approach - The HGU-35/P design features kevlar laminate/honeycomb reinforced lightweight high strength shell, logistically supportable form-fit liner, rear entry oxygen hose, state-of-the-art communications components and unobstructed visibility.

c. Goals - Improved aircrew mission performance by development and acquisition of an integrated helmet system which offers optimum head movement, stability and visibility, and is lightweight.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - The APH-6 helmet/A-13A oxygen mask combination severely compromises VF/VA aircrew performance due to its weight, bulk, misplaced center of gravity and instability during high "g" ACM.

b. Payoff - The HGU-35/P system will offer increased aircrew head mobility, unobstructed visibility and minimized aircrew fatigue.

c. Risk - None. Entirely within the state-of-the-art.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other USAF

The Life Support SPO at Wright-Patterson AFB.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support System
Sub-Task Title: CWU-48/P Aramid Knit Flyer's Coveralls
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Aug 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. DeSimone (6002); 215/441-2187
Project Engineer: E. Boscola (60302); S. M. Reeps (603316)
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-5311D/Lionel I. Weinstock
CNM Product Area No./Title:

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective - To develop a more comfortable and esthetic aviator coverall with fire protection improved over that of the current CWU-27/P coverall.

b. Technical Approach - Design a flyer's coverall using warp-knit, high-temperature-resistant aramid fabric. The final design will be evaluated by Navy, Air Force, and Army personnel for tri-service application.

c. Goals - To retard thermal damage simulating injury, during a 3-second exposure to an AvGas fire, of a test manikin having only a T-shirt and shorts beneath the coverall, as evidence by occurrence of severe burn indication over less than 35% of its body surface.

2. Justification a. Problem b. Payoff c. Risk

a. Problem - Aircrewmen require protection from aircraft fires that occur most often during takeoffs, combat, collision and crash landings. Thermal protection must provide a delay of at least 3 seconds to allow time for egress or ejection.

b. Payoff - Reduction of fatalities or severe injury to crewmen in the event of fire.

c. Risk - None.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

The final design of the coveralls is to be evaluated for tri-service application.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: MBU-14/P Aircrew Oxygen Mask
Program Status: On-going ☒ Proposed ☐ Planned ☐ Date: 1 Aug 1978
Performing Laboratory/Center: Naval Air Development Center/ACSTD
Technical Coordinator/Phone: D. De Simone 6002 AV-441-2187
Project Engineer: E. Boscola/J. Castine AV-441-2858
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description

a. Objective b. Technical Approach c. Goals

a. Objective - To conduct T&E and determine if the lightweight low profile MBU-14/P oxygen mask assembly developed by Sierra Engineering Co. as a replacement for the USAF's MBU-5/P mask, is an acceptable replacement for the Navy's heavy/bulky A-13A mask assembly.

b. Technical Approach - The MBU-14/P mask is constructed as a one piece plastic hard shell with a silicone rubber facepiece. Also, a combination inhalation/exhalative valve, a soft (non-reinforced) hose and offset bayonets are used.

c. Goals - To provide an improved lightweight/low profile oxygen mask assembly in the Navy's inventory as a replacement for the current heavy/bulky A-13A mask assembly.

2. Justification

a. Problem b. Payoff c. Risk

a. Problem - The A-13A oxygen mask assembly used by Navy/Marine aircrews limits performance due to its weight, bulk, and instability under "g".

b. Payoff - A lightweight, low profile, oxygen mask assembly will improve aircrew performance, particularily during high-G maneuvers, in high performance aircraft.

c. Risk - None

3. Program Coordination

Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other USAF

This program has been coordinated with the Life Support SPO (ASD/AELS) WPAFB.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Solid Chemical Emergency Oxygen System
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM/441-2187
Project Engineer: E. Boscola
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To develop the capability to provide breathing oxygen to aircrewman under emergency conditions while eliminating the logistics and maintenance burdens imposed by current systems.

Technical Approach - Complete development of a solid chemical breathing oxygen system for installation in the RSSK kits, utilizing the decomposition of sodium chlorate as the oxygen source.

Goals - Improve safety, reduce and/or eliminate logistic support, servicing, maintenance, and support personnel, and lower life cycle cost factors consistent with the goals of the On-Board Oxygen Generating System Program.

2. Justification a. Problem b. Payoff c. Risk

Problem - Logistics, maintenance problems and safety hazards associated with liquid oxygen systems are a continuing threat to the effective operations of aircraft operating from carrier and remote bases. Elimination of LOX requirements as a result of the anticipated introduction of On-Board Oxygen Generating Systems will make the development of an emergency oxygen system a necessitity.

Payoff - Elimination of the logistics and maintenance problems associated with LOX and GOX requirements, fire hazards and casualty vulnerability, consistent with the intent of the On-Board Oxygen Generating Systems.

Risk - Development and T & E have demonstrated low risk for this oxygen generating technology. Some risk is involved in defining a proper packaging technique for other survival equipment within the RSSK.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other

USAF and Army will be kept informed through the Flight Environment Working Group of the Tri-Service Support Steering Committee chartered by DDR&E.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Dual Mode Ejection
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. DeSimone (215) 441-2187
Project Engineer: C. Woodward
Contributing Laboratory/Center: NWC, China Lake
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: Develop a control system that can selectively prevent ignition of the rocket sustainer used in certain aircraft escape systems in order to achieve low altitude/adverse attitude escape capability.

b. Approach: Provide the engineering development of a system that will automatically deactivate rocket initiation on Martin-Baker seats when aircraft pitch or role exceeds 90°.

c. Goals: To improve adverse - attitude/low altitude escape capability on existing MBA seats which have separate rocket/catapult propulsion systems.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Present escape system designs compromise low altitude ejection performance both under high sink rate and adverse attitude conditions. The former requires high thrust to obtain sufficient height for recovery, while minimum thrust is indicated if the aircraft is inverting. Martin-Baker and Stencel seats have separate catapult and rocket propulsion systems, enabling rocket deactivation for ejecting in the downward direction.

b. Payoff: Improved low altitude, adverse attitude escape by the addition of an automatic, fail safe connect/disconnect of the rocket motor initiator, which takes its signal from the aircraft attitude sensors.

c. Risks: Risk of development is considered low or none.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other ____

This development has direct application to the Air Force F-4 aircraft, which utilizes the MBA seat. Benefits gained will be across tri-service lines and coordination will be maintained in this area by the Navy.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Anti-Exposure/Flotation
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone (215) 441-2187
Project Engineer: E. Boscola/S. Reeps/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To develop equipment and integrated systems that will provide greater protection to cold exposure than is now made available to military crewmen of all flight communities. Also to develop flotation equipment which is more effective than existing equipment and compatable with the new anti-exposure systems.

b. Approach: The approach will be multi-faceted and will deemphasize the use of constant wear equipment and rely more on auxiliary equipment. Specific programs will include development of:

1) New technology anti-exposure equipment
2) All weather mini-boat
3) Inflatable hoods and mittens
4) LPU-20/P life preserver
5) Mobile crewman preserver
6) Mini-boat (Helo)

c. Goals: To improve the cold exposure protection and flotation elements of survivability for flight personnel.

2. Justification a. Problem b. Payoff c. Risk

a. Problems: Anti-exposure protection and personal flotation have been unsatisfactory in many instances due to dependancy on constant wear configurations, poor compatability with associated equipment, poor reliability, inability to meet operational requirements, and poor maintainability.

b. Payoff: A saving of lives, and an economic gain through greater reliability in performance of equipment.

c. Risk: The technologies required in the above developments are within the state-of-the-art.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☒ TriService ☐ Other

The Army and USAF will be kept informed of the Navy's unique efforts in this field.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 6426N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Anti-Exposure/Flotation (New Technologies for Anti-Exposure Application)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone
Project Engineer: E. Boscola/S. Reeps
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide each of the flight communities with optimal anti-exposure protection necessary to meet their specific operational requirements. New technologies will be investigated and applied in developing new protective systems.

b. Approach: Establish specific mission requirements with consideration for protection/flying comfort trade-offs; obtain sample anti-exposure assemblies and systems; conduct and determine physiological protectiveness of equipment; Determine the logistic supportability.

c. Goals: To enhance the inflight confort of aircrewmen while maximizing his cold water protection.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Currently, the U.S. Navy is utilizing a variety of anti-exposure garments; much to the dissatisfaction of the fleet. The dissatisfaction is based upon general discomfort, poor logistic supportability, and poor integration with associated equipment.

b. Payoff: By improving the effectiveness and in-flight comfort of cold water protective equipment, increases will occur in the performance, survivability, and morale of the affected aircrew men.

c. Risk: Short and long term approaches within the state-of-the-art.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☒ Other

No direct participation with other services, however, they will be kept informed of the results of this effort.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support System
Sub-Task Title: Anti-Exposure/Flotation (All Weather Mini-boat)
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: ACSTD/NAVAIRDEVCEN
Technical Coordinator/Phone: D. N. DeSimone (215) 441-2187
Project Engineer: E. Boscola/R. A. Zaffiri
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To determine the feasibility of supplementing the inherent thermal protection afforded by the insulative structure of mini-boats.

b. Approach: Design approaches will include the use of a closable/reclosable canopy, investigation of reflective heat sealable materials, the adaptation thereto of a one-man body-heating device (DAPS), and the vacuum packaging (with tear-strip opening) of this system. Thermal testing will be conducted to prove the design.

c. Goals: To provide the optimum balance between duration of low temperature exposure protection and minimum size and weight of the stowed, long-shelf-life mini-boat package. To prevent exposure to rain, wind, spray and the wash of waves over the gunwales by completely enclosing a mini-boat.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Military life rafts are excessively heavy and bulky. Their materials and their cemented seams deteriorate with age. Seam deterioration has enforced the practice of regular pressure testing which accelerates such deterioration. Constant-wear exposure protection has also been a long standing problem aggravated by the increasing demands on aircrewmen in the performance of their mission.

b. Payoff: The welded or heat=sealed mini-boat is a lightweight, small, efficient flotation platform that should enjoy a long life with vacuum packaging. The primary payoff will be the optimum exposure protection available for survivors in this passive system and the potential increase in mission performance because of the reduction in bulk of constant-wear habiliments it offers as compared with life rafts. Another payoff is the shelter provided by such an insulated enclosure for survivors on land. The logistic payoff will be the reduction of maintenance effort.

c. Risk: Since the superiority of mini-boat flotation and the DAPS heat source have already been proven, there appears to be no risk in the technical approach.

d. Applicable STO's - SL 12-D-9; 12-G-16. High priority.

3. Program Coordination Other Navy ☒ USMC ☐ Army ☐ USAF ☒ TriService ☐ Other _____

Technical Report and liaison with U.S. Air Force.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Anti-Exposure/Flotation (Inflatable Anti-Exposure Hood & Mittens)
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone (215) 441-2187
Project Engineer: E. Boscola/S. Reeps
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide a replacement for current anti-exposure hoods and mittens (MIL-H-81500 Hood and MIL-M-81534 Mittens) which would reduce bulk and weight of the items while not compromising anti-exposure protection for downed aircrewmen in cold water survival situations.

b. Approach: To evaluate available coated fabrics, and hood and mitten designs to determine optimum design and material choices.

c. Goals: To provide hand and head protection to cold exposure.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The hoods and mittens, which are a necessary component of the exposure protective system, must be carried in the pockets of the anti-exposure suit. Due to excessive bulk and weight of current equipment, the gloves and mittens create an encumberance within the cockpit.

b. Payoff: Reduction of the occurrence of fatalities due to cold water exposure.

c. Risk: Entirely within the state-of-the-art.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

No direct participation with other services, however, they will be kept informed of results of this effort.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Anti-Exposure/Flotation (LPU-20/P Life Preserver)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. De Simone (DPM) AV 441-2187
Project Engineer: E. Boscola/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title:

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide aircrewmen with an improved life preserver having increased buoyancy and optimum in-water balance characteristics especially for the unconscious crewmen.

Technical Approach - The design will include two separate heat sealed bladders consisting of collar and waist lopes which inflate independently of the other to assure adequate flotation and balance. Permanent heat sealed bladder seams will increase bladder strength to withstand higher inflation pressures.

Goals - To provide increased flotation to enhance the survivability of the downed aircrewmen. Full inflation within 30 seconds with a reliability of .90 and a 90% confidence level. Also a reduction in servicing and maintenance due to improved bladder seams.

2. Justification a. Problem b. Payoff c. Risk

Problem - The problems with the predecessors of the LPU-20/P preserver (LPA-1, LPA-2, LPA-21/P) have been one or all of the following: unreliable bladder seam integrity; lack of fire retardening qualities in the bladder cover; the necessity fo proper sequencing of the legs and right CO_2 inflator inflation.

Payoff - The payoff will be in the greater reliability of inflation and the ensuing saving of lives; the fire resistance of the preserver assembly; and the decrease in the need of maintenance and repair.

Risk - The technical problems involved in this program are negligible.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☐ USAF ☐ TriService ☐ Other

No direct participation with other services. The other services will be kept informed of program progress.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Anti-Exposure/Flotation (Mobile Crewmen Preserver)
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone
Project Engineer: E. Boscola/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide certain crewmen of helicopters with a reduced-size constant-wear preserver which will enable them to perform their specialized mobile inflight duties.

b. Approach: Develop a suitable perserver that is adequate in buoyancy, and when stowed on the body, is compatible with associated equipment and permits unencumbered performance of inflight duties.

c. Goals: To provide required personal flotation to the mobile crewman without impeding his onboard duties.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: The mobile crewman, very often faced with very physical responsibilities, is hampered by a cumbersome life perserver and as a result chooses to stow it rather than wear it as required.

b. Payoff: Improved compliance, by the helo mobile crewman, of his duties without removal of his required life perserver.

c. Risk: None

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☒ TriService ☐ Other

No direct participation with other services. The Army and USAF will be kept informed of the Navy's unique efforts in this field.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Anti-Exposure/Flotation (Mini-boat Helo)
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 October 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM (215) 441-2187
Project Engineer: E. Boscola/G. Gillespie 441-2857, 2512
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5 Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

a. Objective: To provide help aircrewmen with one-man flotation vessels for interior stowage near exit points.

b. Approach: Investigate methods of packaging mini-boats and places for stowing them in helicopters for easy access during emergency egress.

c. Goals: Provide helo aircrewmen with survival protection at least equivalent to that afforded other aviators.

2. Justification a. Problem b. Payoff c. Risk

a. Problem: Aircrewmen generally have less than a minute to escape from ditched helicopters, which usually overturn, subjecting them to injuries, water-inrush forces and disorientation. Consequently, the odds against removal of the heavy and bulky multi-place life rafts are as high as 10:1.

b. Payoff: Ready availability of these compact, insulated, flotation vessels should double or triple survival rates in winter, cold latitudes and rough water.

c. Risk: Vacuum-packaging techniques for long stowage life are well known, not only in food preservation but also for instruments, etc. Developmental parachute packaging, with projected service life of 15 years, has been designed by NPTR. The state-of-the-art justifies confidence that mini-boats can be similarly and inexpensively sealed for instant deployment.

3. Program Coordination Other Navy ☐ USMC ☐ Army ☒ USAF ☐ TriService ☐ Other

No direct participation with other services. The Army and USAF will be kept informed of the Navy's unique efforts in this field.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Aircrew Survival Systems
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN /ACSTD
Technical Coordinator/Phone: D. DeSimone, DPM/441-2187
Project Engineer: E. Boscola/G. Gillespie
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide helicopter aircrewmen with mission-specfic personal equipment configurations to meet the specific operational requirements of each category of crewman. These include: The mobile Vertrep crewman, the passenger, the rescue swimmer, and the pilot/co-pilot.

Technical Approach - After establishing specific mission requirements, develop integrated clothing and personal equipment configurations that will permit optimum inflight performance & survivability in an emergency situation.

Goals - To enhance inflight comfort & performance, specialized capabilities, and cold water survivability.

2. Justification a. Problem b. Payoff c. Risk

Problem - Currently, many flight personnel are using personal equipment and combinations thereof which were not designed specfically for their specialized roles and missions. This very often compromises performance, and effectiveness of survival.

Payoff - Improvement of mission effectiveness, inflight comfort, survivability, for all helicopter aircrewmen.

Risk - All approaches within the state-of-the-art.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

The Army and USAF will be kept informed of the Navy's Unique efforts in this field.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Aircrew Survival Systems (Mobile Vertrep Crewman Configuration-Helo)
Program Status: On-going ☐ Proposed ☐ Planned ☒ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: G. Gillespie/E. Boscola, 441-2857, 2512
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide a mobile/Vertrep crewman equipment configuration which provides satisfactory survival capabilities and is fully compatible with mission performance.

Technical Approach - Determine the needs of the mobile/Vertrep crewman for successful mission performance. The state of the art will be scanned to incorporate new technology where applicable. A new system will be developed to optimize crewman performance.

Goals - To provide constant wear habiliments safely and comfortably compatible with the unique flight duties of the mobile/Vertrep which will also provide him in emergency with resources better suited for survival and rescue. This system will reduce bulk, weight and thermal discomfort.

2. Justification a. Problem b. Payoff c. Risk

Problem - Various helo crewmen perform unique mission duties (lying on their stomach for Vertrep, cargo handling, hoisting during Mine Countermeasures, etc.) and in doing so, they must wear standard aircrew survival equipment. This equipment significantly impairs and degrades the performance of these special crewmen, partially because of the equipment's bulk and weight, but primarily because of its interference with the body movements/positions required during these missions.

Payoff - Greater capability and efficiency for the mobile Vertrep crewman in performing duties in his specialty and increased survivability during emergencies.

Risk - (a) The life preserver must have helmet compatibility when inflated. Therefore, the proper interface must be determined before the system can be tested.

(b) The life preserver must be of sufficient buoyancy to support an armored aircrewman.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

No direct participation with other services. The Army and USAF will be kept informed of the Navy's unique efforts in this field.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Aircrew Survival Systems (Passenger Configuration-Helo)
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: G. Gillespie/E. Boscola, 441-2857, 2512
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide helo passengers with an inflatable life preserver that is capable of quick donning, compatible with suits and combat equipment and easily stowed and maintained.

Technical Approach - Provide a quickly donned life preserver pack incorporating full buoyancy and optimized distribution of flotation as well as preventing face-down attitude. New materials permitting welded construction for long shelf life with minimum maintenance will be used.

Goals - A low-cost, low-bulk, low-maintenance passenger life preserver compatible with helmets and suitable for use of troops and other passengers not having regularly assigned duties aboard.

2. Justification a. Problem b. Payoff c. Risk

Problem - Since passengers may wear anything from suits to combat equipment, the required personnel-flotation device must be easily worn by all and be easily stowed and maintained. The current life preserver requires the user to remove his helmet before donning. The preserver is relatively expensive and bulky.

Payoff - The Navy will be able to buy a universal, inexpensive and properly designed life preserver that will require no maintenance (only routine inspection). The preserver will be stowed readily available to all passengers and will provide greater survivability.

Risk - Entirely within the state of the art.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

No direct participation with other services. The other services, particularly the Army, will be kept informed of results.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Aircrew Survival Systems (Rescue Swimmer Configuration-Helo)
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: G. Gillespie/E. Boscola, 441-2857,2512
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide the rescue swimmer with a configuration that is easy to don, allows for a high degree of body freedom for safe water entry, and for successful mission.

Technical Approach - Based on a thorough Fleet survey, design an upper torso harness with lift D-ring anchored at chest level to circumferential webbing and including a personal flotation device (PFD) integrated with the harness and also secured behind the head; and a utility belt, equipped with pouches for survival items, including radio, shroud cutter, flares and strobe light, each line secured to the belt to afford freedom of usage and prevent loss in water. A method of securing the survivor to the rescue swimmer, and transferring the survivor's weight to the suspension line without interfering with the swimmer's duties is also required.

Goals - Increase the ability of the helicopter rescue swimmer to accomplish speedy rescue of survivors and thereby enhance their survival opportunity.

2. Justification a. Problem b. Payoff c. Risk

Problem - To perform his rescue mission, the rescue swimmer requires special equipment; however, the existing equipment is non-standard, hard to don and in some cases causes injury. The improvised equipment compromises timeliness, speed of the operation and/or efficiency, thus contributing to mission failure and potential loss of life.

Payoff - Quick and effective survivor rescue and return to duty.

Risk - None

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

USAF and Army will be kept informed through the Flight Environment Working Group of the Tri-Service Life Support Steering Committee chartered by DDR&E.

PROGRAM MANAGEMENT SUMMARY OF RESEARCH & DEVELOPMENT EFFORTS

Program Element No.: 64264N Task Area Title: Airborne Life Support Systems
Sub-Task Title: Aircrew Survival Systems (Pilot/Co-pilot Configuration-Helo)
Program Status: On-going ☐ Proposed ☒ Planned ☐ Date: 1 Oct 1978
Performing Laboratory/Center: NAVAIRDEVCEN/ACSTD
Technical Coordinator/Phone: D. N. DeSimone, DPM, 441-2187
Project Engineer: G. Gillespie/E. Boscola 441-2857,2512
Contributing Laboratory/Center:
Cognizant SYSCOM Code: AIR-531
CNM Product Area No./Title: 5/Crew Equipment and Life Support

1. Program Description a. Objective b. Technical Approach c. Goals

Objective - To provide an on-person-equipment configuration that is designed to be comfortable, light weight, unencumbering and to have good heat-dissipating properties.

Technical Approach - Integrate newly developed survival equipments and redesigned current equipments into a comprehensive system which will include the miniboat, LPU-20P, optional body armor (for attack helos), life capability and survival equipment stowage.

Goals - Increase the efficiency of the helicopter pilot/co-pilot during the mission profile and enhance the capability of his flotation complement to at least the equivalent of that provided for the fixed-wing pilot.

2. Justification a. Problem b. Payoff c. Risk

Problem - The discomfort and mobility restrictions imposed by the bulk and weight of present survival gear add significantly to the fatigue that must be endured by the pilot under helo heat and vibration. This results in overall degradation of mission performance, an increase in the possibility of injury or accident and degradation of the airman's capability for emergency egress and survival.

Payoff - Greater probability of mission success and multiplication of survival and rescue opportunity in emergency by a factor in excess of two, particularly in cold and/or rough water.

Risk - The results of a techeval appear to have eliminated the customary risks associated with advanced development.

3. Program Coordination Other Navy ☐ USMC ☒ Army ☒ USAF ☒ TriService ☐ Other

No direct participation with other services. The Army will be kept informed of Navy progress.